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THE

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The American Resin Industry.*

Practically the most important result of the work of the Division of Forestry, during the year 1892, was the proof of the fact that the extraction of resin from the Southern species of pine does not, as commonly supposed, influence the quality of the wood. The opinion, that the timber of trees which have been tapped loses its durability, is not confirmed by chemical analysis, which shows that tapping causes no alteration whatever in the chemical composition of the heartwood, as the turpentine collected all comes from the sapwood, which alone contains it in the fluid form. Nor is there any physiological reason why any such alteration should take place.

It may therefore be asserted with absolute safety that the prejudice of architects and builders against wood which has been tapped is groundless, and this view has been confirmed by actual experiment. Nevertheless, the turpentine industry is the greatest enemy of the forests of the Southern States, although there is no reason why it should be so.

By tapping immature trees and careless tapping a great deal of unnecessary loss is caused; fire, which every year passes through the forests, destroys millions of cubic feet of very valuable timber, the dried resin left on the trees making them most inflammable, and many trees which are not actually consumed by fire are blown down by storms, and become excellent breeding places for destructive insects. For this reason forests, five or six years after the tapping has ceased, present an appearance of utter desolation, which extends even to the young growth, so that reproduction is out of the question. In 1890, over 2,000,000 acres of pine forests, tapped for resin, suffered from these evils, and every year the tapping is extended over from 500,000 to 600,000 acres of fresh forest.

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* **Abridged translation of an article by Schleicher in the Allgemeine Forst und Jagd Zeitung.**

This state of affairs led the Division of Forestry to undertake a thorough investigation of the whole system of turpentine tapping, the results of which are given below.

The principal minor forest product of the United States is tanning-bark, and next to that comes turpentine, the extraction of which is confined to the pine forests of the Southern States, within, a belt about 100 miles broad, bordering the Atlantic and Gulf coast-lines from North Carolina to Louisiana.

This industry covers a large proportion of the world's supply, amounting in value to nearly £2,000,000 annually, but its importance lies even more in its bearing on the future of one of the richest sources of forest wealth in America.

Fernow is of opinion that owing to irrational and wasteful methods, and to the forest fires which are largely consequent thereon, the resin industry, notwithstanding the great value of the outturn is, from an economical point of view, a most unprofitable one. He hopes, by his work, to draw general attention to the methods of working, and to point out the means by which the evils above indicated may be avoided.

"Naval Stores" is the collective name for all resinous products. The name probably has its origin in the fact that these products were formerly mainly used for shipbuilding purposes, which is no longer the case, since iron has largely taken the place of timber.

Resin, or crude turpentine, as obtained from the tree, is a mixture of resin and turpentine, the former being partly dissolved and partly suspended, in the latter. Its consistence varies according to the species of tree from which it comes, the more oil it contains the more fluid it is. "Fine" resin, obtained from the larch, spruce, or balsam, is semi-fluid, more or less transparent and clear, and remains clear when exposed to the air. "Common" resin, the product of other resinous trees, is generally not quite transparent and becomes hard as the oil evaporates. Most kinds of resin are yellow or brown coloured, and turn dark on exposure to the air. They possess a characteristic smell and taste, their specific gravity is nearly 1, and they melt at a low temperature. They are insoluble in water, but dissolve readily in alcohol, ether or oil of turpentine; they contain no nitrogen, little oxygen, and much carbon; they have a slightly acid reaction, and in combination with alkalies, form soap. The best quality is, as a rule, but not necessarily so, the product of the first year's tapping, and is known under the name of "soft white gum," or "virgin dip." In the following year the produce is called "yellow dip," and with every year it becomes darker and loses fluidity. The scrapings, or solidified resin, is the residue which has dried on the tree.

The most important articles of commerce are obtained by the distillation of these products. The first result is oil or spirits of turpentine. When chemically pure it is a mixture of various hydrocarbons with the formula $C_{10}H_{16}$ while the impure article contains also other hydrocarbons and acids. Rectification is effected by adding lime-water and re-distilling.

Oil of turpentine possesses the following qualities; when freshly made, especially from virgin trees, it is colourless, tasteless, very fluid, and has a peculiar smell, its specific gravity is 0·855 to 0·875, and its boiling point is from 150° to 160° C. Most commercial oils have a left-handed polarisation. American oil, on the other hand, is right-handed, which is a simple method of distinction.

The oil is volatile at ordinary temperatures, becomes by oxidation hard and yellow and has an acid reaction. It burns with a very sooty flame, and is insoluble in water, but soluble in alcohol. It is a good solvent for many resins, wax, fats, caoutchouc, sulphur, and phosphorus, and is used in the manufacture of varnish and paint. Mixed with oil it also serves as an illuminant; it is used in medicine, both externally and internally, and probably for the adulteration of many essential oils.

Colophony is the residue after distillation of crude turpentine. Like the latter, its properties vary according to the period of its collection, and it ranges from transparency to complete opacity. The colour runs through all shades from bright yellow to dark brown or nearly black. Some kinds are so soft that they can be scratched with the finger nail, and others are so hard that it requires iron to make any impression. Colophony is nearly without smell or taste, very brittle and easily powdered. It becomes soft at a temperature of about 80° C. and melts between 90° and 100° C. As regards solubility, it resembles raw resin. Its specific gravity is 1·07. It is used in the manufacture of soap, varnish, sealing wax, cement, and paper. In the American market no less than 13 different qualities are recognised.

The following three products are obtained by the dry distillation of colophony:—

(1) Light colophony oil, used for varnishes;

(2) Heavy colophony oil used for printer's ink, lubricating, &c.

These oils which are known in the trade as pale oil, pine oil, printer's oil, &c., are of a red or brown colour, and more or less fluorescent. They have a specific gravity of from 0·98 to 1·00, a faint smell and a characteristic taste. Distillation is carried on over a slow fire and gives 85% of oil. These oils consist of a mixture of hydrocarbons of indeterminate nature and contain as much as 15% of resinous acids. They are insoluble in water, slightly soluble in alcohol and do not saponify, but form unsoluble combinations with slaked lime and other bases. The resin-grease which is produced by the addition of fine slaked lime suspended in water, is a first-rate lubricant. Mixed with palm-oil, colza, or the thicker mineral oils, it is used for the manufacture of lubricating oils. It is also used in the preparation of varnishes and cheap paints,

(3) Common pitch or the residue of the dry distillation of colophony, is a shining black substance of great brittleness, used by shoemakers and shipbuilders. Pitch can also be made by boiling tar till it has lost one-third or more of its original weight. Pitch of commerce contains more or less inferior colophony and commands a price of about 6 shillings per barrel of 30 gallons.

Brewer's pitch is obtained by stopping the distillation of crude turpentine before all the oil has come over. It contains therefore a certain quantity of turpentine oil. If the latter is in excess, the pitch smokes when melted and gives a disagreeable sharp taste to the beer, if insufficient in quantity the pitch is brittle, and scales off in the barrels. The best quality is obtained from the larch, and comes principally from the Tyrol. A good deal of brewer's pitch is also made in the Southern States of North America.

Pine tar is principally obtained by the dry distillation of wood, and most of it comes from North Carolina where this industry has been vigorously carried on since the earliest colonial times. In the remainder of the Southern Pine Zone it is only made for home use.

The process of manufacture is as follows. The heartwood of perfectly dry trunks and branches of the long-leaf pine is cut into small pieces and piled up in a conical heap in a circular basin in the ground lined with clay. The centre of the basin communicates by means of a pipe with a pit in the ground three or four feet distant from the heap. The latter is covered with turf and earth, and is treated in every way like an ordinary charcoal kiln. The flow of tar begins nine or ten days after the kindling of the kiln, and lasts for several weeks. The tar is emptied from the pit into casks of 320 lbs., which as a rule are made of the same kind of wood as the tar. A 'cord' of dry wood (2000 lbs.) gives 40 to 50 gallons of tar. The profits of this business are small, but it is carried on at a time when hardly any other work is practicable. The price in Wilmington, N. C., per barrel of 30 gallons was in 1893 about 4/4d. the price having fallen in consequence of the cheaper production of tar as a bye-product of charcoal burning in iron retorts.

Finally tar-oil is a product of the distillation of tar. It is a mixture of hydrocarbons with a little wood spirit and a small quantity of creasote. It has a density of 0.877 and is used as an insecticide and for external use in domestic and veterinary medicine.

The resin of commerce comes mainly from Austria, France, Corsica, Spain, Portugal, Galicia, Prussia and the United States. Most of the European turpentines are obtained from *Pinus laricio* and *Pinus maritima*, the former yielding the greatest quantity, especially in Lower Austria, France and Corsica. *Pinus maritima* is principally grown in France, between Bayonne and Bordeaux, where there are 1,500,000 acres of forest, The larch in South Italy and the Italian Alps gives a resin of first class quality, though only in small quantities per tree per year, which is known in trade as Venetian turpentine Occasionally, more especially in Galicia and Russia, the spruce and Scot's pine are tapped The turpentine of the last named species, which is also collected is Alsace, is sold under the name of Strasburg turpentine Hungarian turpentine is derived from *Pinus pumilio*

In the United States, at the time of the colonisation, a considerable quantity of resin was collected from the pitch pine (*Pinus rigida*) of the North Atlantic States but this species is now so nearly exterminated that the industry has practically died out and the manufacture is entirely confined to the South, where three species are found which yield turpentine in large quantities :

(1) Long-leaf pine, *Pinus palustris* ,
(2) Loblolly pine, *Pinus taeda* ,
(3) Cuban pine, *Pinus Cubensis*

The two last give a fluid resin rich in volatile oil, which on distillation leaves behind only a small quantity of hard colophony. The resin of these two trees flows so readily, that the yield only lasts one season They are therefore, considered unworkable, except when they occur mixed with *Pinus palustris* It is, however, possible, and even probable, that with careful management they may be made more productive and that the stretches of forest of *Pinus taeda* in Arkansas, Louisiana, and Texas, as also the forests of *Cubensis* in Florida, may yet become valuable sources of resin

At present *Pinus palustris* supplies the principal demand, not only of the United States but also of the whole world, as the production of France and Russia (which are the only other countries that need be considered) taken together only amounts to one-tenth of the total out put

The earliest collection of resin from *Pinus palustris* took place in North Carolina, where, together with the manufacture of pitch and tar, it was a source of income to the first settlers, and in later colonial times became a highly paying industry, supplying an important export trade During the three years, 1768 to 1770, the export to the mother country amounted to 88,111 barrels 30 gallons crude turpentine, 20,646 barrels pitch, and 88 366 barrels tar, worth altogether 215,000 dollars This has gone on increasing up to the present, the value of the exports of resin and turpentine in 1893 being 8,682,000 dollars

The method of tapping for resin varies with the country and species of tree Corresponding with the position of the resin in the tree, the following three methods may be distinguished .—

(1) A blaze is made on the tree, which is enlarged every year, and the resin is either collected in a hollow at the foot of the blaze (or, as in France, in a special vessel), or else allowed to get hard on the blaze and then scraped off, as in the case of the spruce

(2) Holes are bored into the part of the tree where the resin is formed or stored up, as in the heartwood in the case of larch

(3) The resin ducts in the bark are opened, as is done in the case of the balsam fir

Apart from the species of tree, the production of turpentine depends on—

(1) The dimensions of the tree, the production, *cæteris paribus* increasing directly with the size

(2) The situation, everything that is favourable to the growth of the tree, such as an open or sunny locality with an easterly or southerly aspect, increases the production of resin

(3) The weather, particularly during the time of collection; prolonged heat and continuous rain are equally unfavourable, and a cold spring always prognosticates a poor harvest The flows of resin increase from spring to autumn

(4) The length of time the tapping lasts, during the first two or three years the yield is less than in those following The Austrian pine appears to yield its maximum between the fourth and fifth year, or, in the case of very large trees, between the seventh and ninth year This species in favourable localities can stand continuous tapping for 30 years but it ceases to pay after six or eight years in the case of small stems or ten to twelve years in the case of larger trees

(5) The skill and care with which the tapping is done As regards the age at which the tapping should be carried out, it has been shown that the best time is when the tree has reached its greatest height and has, so to speak, arrived at maturity The investigations of Fernow show that the maximum production of the long-leaf pine lies between the ages of 70 and 80 years He is of opinion that the maximum is generally reached when the formula $\frac{d}{a}$ (diameter divided by the age in years) has its greatest value With a view to the subsequent utilisation of the trees as timber, he fixes the minimum diameter at which tapping should commence at 14 inches but the best size for both turpentine and timber production would be a diameter of from 18 to 20 inches

In France, 14 inches, corresponding to an age of 30 years, is considered a reasonable minimum In Austria, tapping begins when the trees are from 8 to 10 inches in diameter, or, in the case of the spruce, 12 inches In the United States, on the other hand, every tree which appears likely to yield a profit to the extractor is ruthlessly tapped, under which course of ill-treatment the industry is digging its own grave

Fernow draws attention to the relationship that exists between the formation of resin and the state of the foliage, and points out that a tree can only yield resin in abundance so long as it is in perfect health, especially in the case of species like the long-leaf pine, in which the resin is produced in the sapwood These matters ought to be taken into consideration in regulating the width and number of the blazes, while the facts that the resin ducts run vertically and that a long lead from the point where the resin exudes causes evaporation and consequent loss, indicate the desirability of making the blazes as short as possible

Under the rational French system, the blazes are made 4 to 5 inches broad, with a depth of barely half an inch, and at the commencement are not more than 4 inches long Under this treatment the tree can continue to yield resin throughout the term of its natural life In Austria the trees are blazed over two-thirds of their circumference, and the length is at first only two inches. In the United States, "boxes" or reservoirs to catch the resin, are cut 10 to 12 inches deep in the tree, and the blazes are 12 to 14 inches wide, their number varying according to the size of the stem, no regard whatever being paid to the future well-being of the tree

The American system, therefore, in no way fulfils the conditions of economical tapping, the Austrian system does so to a certain extent, but the French plan is the only rational one

Frequent emptying of the resin reservoirs diminishes the loss of oil by evaporation Scraping should be done only with the greatest care, and as there is practically no evaporation from the dried resin, it need not be often repeated

The following is an exact description of the American method as described by Dr Charles Mohr, Agent to the Division of Forestry

In establishing a turpentine ‘ orchard ” and still, two considerations must be taken into account first suitable conditions, with regard to the export of the manufactured article and secondly, a sufficient supply of water for condensing. The copper stills commonly in use have a capacity of 800 gallons, which corresponds to a charge of from 600 to 750 gallons of crude resin To keep a still of this size in continuous work during the season, filling it twice a day, not less than 4 000 acres of well-stocked pine forest are required A block of this size is divided into 20 compartments, each with about 10,000 "boxes," or resin reservoirs cut into the tree A compartment is termed a "crop," and is the unit allotted to each workman The work begins in the early winter with the cutting out of the boxes Until a few years ago, no trees were tapped under 12 inches in diameter, but recently, the workings have included trees as small as 8 inches Two to four boxes are made in each tree according to size, so that 10,000 boxes require 4,000 to 5,000 trees, or about 200 acres of forest.

The boxes are cut 8 to 12 inches above the base of the tree, 6 to 7 inches high by 14 inches broad, slanting inwards at an angle of 35 degrees, and penetrating 7 inches into the tree The reservoir is capable of holding about 3 pints

To protect the boxes from danger of fire, the ground is cleared within a radius of three feet of the tree, and all inflammable material is heaped together and burnt. The burning of these heaps destroys the surrounding young growth, and unless care is taken, spreads to the neighbouring forest for miles round.

The flow of turpentine begins with the first days of spring and at the same time the "chipping" is begun, by which a blaze is made, 2 inches broad, 1 inch deep, and 10 inches high immediately above the box The surface of this blaze is then chipped or hacked, for which purpose a special tool called the "hacker" is used. This is a strong knife with a curved edge fastened to an iron handle, at the other end of which is an iron ball of about 4 lb weight serving to give impetus to the blow

When the flow begins to diminish, new cuts are made with the hacker, and this is repeated from March to October, often lasting over 32 weeks The length of the blaze increases every month from 1½ to 2 inches

The accumulated resin is scooped out of the boxes with a ladle, and emptied into a cask for transport to the factory. During the first season the boxes are emptied seven times on an average, the 10,000 boxes yielding at each emptying about 1,200 gallons of "soft gum" The flow is most abundant during the hottest time of the year, in July and August, and gradually ceases with the setting in of the cooler weather, until in October or November it completely stops When the resin begins to harden, it is scraped out of the box and blaze with a sharp scraper with a wooden handle The result is scrape or "hard gum," which is of a dirty white colour, more or less mixed with foreign bodies, and only contains half as much oil as the soft gum The first season gives a yield of about 8,400 gallons of liquid resin and about 2,100 gallons of hard resin which produce 2,000 to 2,100 gallons of spirits of turpentine and 260 barrels (of 30 gallons) of colophony of superior quality.

In the second year the boxes are emptied five or six times, yielding 6,750 gallons of soft gum and 3,600 gallons of hard resin, from which only about 1 900 gallons of spirits and 200 barrels of colophony are obtained The resin becomes yearly darker in colour and less fluid In the third and fourth years the boxes are only emptied three times, the yield in the third year, being 3,600 gallons of soft resin and 3,000 gallons of hard resin, from which is obtained 1,100 gallons of spirit and 100 barrels or more or less dark colophony In the fourth year the yield of soft resin is somewhat less, and that of hard resin 3 000 gallons, producing 790 gallons of spirits and 100 barrels of colophony of the lowest quality. Tapping ceases as a rule after the fourth year

It appears that the business of distilling requires great care and skill, in order to avoid overheating and loss of spirits, and to ensure that the product is of the best quality

As soon as the still is heated somewhat above the melting point of the resin, a gentle stream of tepid water is allowed to flow into it from the condenser, and this is continued till the end of the process, which is indicated by a peculiar noise arising in the boiling mass, and by the diminished yield of oil from the still. The temperature and amount of water admitted have to be regulated very carefully.

As soon as the distillation is completed the fire is put out and the contents of the still drawn off through a stop-cock at its base. The melted colophony first passes through a wire sieve, and is then filtered through a coarse cotton cloth into a large trough whence it is poured into casks holding 280 lbs. each.

A turpentine distillery working on a basis of 20 "crops," produces during the whole four years 10,000 gallons of spirits of turpentine and nearly 12,000 barrels of colophony or 2,800,000 lbs., worth approximately £12,000. The market price of the spirits of turpentine varies during the same season from a shilling and three halfpence to one-and-sevenpence farthing per gallon.

The average yield of a tree during the period of four years' tapping is from 1.2 to 1.5 gallons of spirits, and 3.75 gallons or 30 lbs. of colophony of the better quality, worth altogether three shillings. The cost of extraction comes to two shillings and twopence-halfpenny, so that the net profit per tree per year is a little less than twopence-halfpenny, or from four to five shillings per acre.

It is calculated from the quantity of resin and spirit annually placed on the market that 2,250,000 acres of forest are in process of being tapped, and that 800,000 acres of virgin forest are every year brought into request, although at the commencement of the report Fernow estimates the latter at only 500,000 to 600,000 acres.

In the final article of the report Dr. Mohr discusses the turpentine industry, and draws attention to the improved method of distilling by steam as practised in New Orleans, which gives 30 per cent. more spirit than distillation over an open fire, without at all affecting the quality of the colophony.

He then describes the method of making turpentine from the wood of the long-leaf pine in an iron retort by means of superheated steam, by which otherwise worthless pieces and sawdust can be utilised. The process is as follows. The wood is cut up into short pieces, and wheeled on iron trucks into a steel retort 20 ft. long and 8 feet in diameter, capable of containing three cords, or 6,000 lbs. The doors are then hermetically closed, and superheated steam introduced, the retort being at the same time heated by means of a moderate fire. Distillation begins after six hours, at a temperature of 150° C., during the next four hours the temperature is raised to 160° C., until no more liquid comes over. Steam is then shut off and destructive distillation over an open fire is commenced. During the next 15 hours the temperature is raised to from 160° to 460° C., and the whole process lasts 24 hours. The residue is charcoal of good quality. A cord of wood yields from

5 to 18 gallons of spirits of turpentine and from 53 to 100 gallons of heavy oils and tar known as creasote, or 60 gallons of strong acids with a specific gravity of 1 02, or 122 gallons of weaker acids. The gas is used for heating the still

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II.—CORRESPONDENCE

What Constitutes a Thinning ?

Your November Number contains a combative article under the above title by Mr Fernandez whom we are glad to welcome back from Europe with all the latest ideas Mr Smythies will no doubt be able to take care of himself and I have no desire to interfere between two such doughty champions, but there are one or two points on which I may perhaps be allowed to make a few remarks.

The first thing that strikes me is the double title which indicates at once that we are to be spectators of a battle in which words, quite as much as facts, are the issues at stake If a thinning is a special operation capable of a precise definition, it is evident as daylight that such an operation, if suitable to a regular forest, cannot be applicable to an irregular one But if we admit that a thinning is whatever you like to make it, sometimes one thing and sometimes another, according to the circumstances of each case, then it becomes possible to admit the term into forests under jardinage, or anywhere else Mr Fernandez' quotation from the orders of the French Conseil d'Administration proves nothing, or too much, since it lays down that the work which Mr. Fernandez would separate out as a special "thinning" is really simultaneous with, part and parcel of, the principal exploitation. It is sad to see Mr Fernandez so severe, and unjustly so, on the Nancy professors, who so far back as 1876 were teaching just what is laid down in the orders quoted True, they did not call it a thinning, any more than the Conseil does, but they certainly admitted the liberation, wherever necessary, of overcrowded crowns in whatsoever story, at each return of the fellings

Mr Fernandez is again most unjust to Messrs Bagneris and Broilliard, in accusing them of disparaging the jardinage system, and in himself calling it "the utilisation of superannuated trees." They laid down nothing of the sort, but a most wise and sufficient rule of practice and taught the method as a distinctly good one Their rule was, to cut first, dead trees, secondly, decaying trees, thirdly, unsound trees, fourthly, trees past maturity, fifthly, a sufficiency of sound trees to make up the possibility. Nowhere can Mr. Fernandez show that trees were to be left till they were dead or decaying Nowhere can he show that less than the possibility was to be cut. In short, the terse old description of the method may be antiquated but it is no more decrepit than the trees it produced The omission to prescribe thinnings, so-called does not go for much, for I find myself at one with Mr Smythies in refusing to apply the term The work done, in addition to the removal of the possibility is essentially a minor cultural operation or executive detail, which if it must have a name, would be more accurately called a cleaning weeding, thinning-improvement-seed-felling Of all these the thinning is precisely the branch that is most limited in practice, for the principal felling is itself a strong thinning, and if much more is done in the way of breaking up the cover, grave elements of danger, from wind, snow, excess of light, drought &c may be introduced But everything depends on the particular forest we have to deal with

Mr Fernandez proceeds to give a set of figures, interesting in their way, and generally to dogmatise in a manner at least as "cock sure" as Mr Smythies No doubt he has other figures, more satisfactory ones producible Otherwise it would be necessary to point out that it is just this laying down of the law on insufficient knowledge which brings the name of "expert" into disrepute The area of the plots is not given it may be less than an acre for all we know since the figures are reduced to the hectare We can only guess from the number of stems The result is obtained after a lapse of only five years, a basis on which no responsible forester would think of building more than the most provisional of presumptions

The figures purport to be a comparison of thinnings *par le bas* and *par le haut* They are really nothing of the sort and this is the sole fact, which the figures conclusively prove In plot No 1, thinned *par le bas* out of 13 390 stems no less than 9 274 were removed leaving only 4 116 trees evidently in a state of isolation, in which condition they would no doubt feel quite as cock-a-whoop as Mr Fernandez himself for a limited period In plot No 2 out of 11 996 trees only 492 were removed,—not one tree in twenty-four so that the amount of growing room given to the crop was really none too liberal A pretty set of figures, indeed, to go into ecstasies over ! If Mr Fernandez has any German ones more to the point, and will be good enough to let us have them, there is no protective tariff Proof is all that is desired, come whence it will, and sacrifice what it will, so it be really proof

At the beginning of this letter is an allusion to a battle of words, rather than facts The reference is to the personal equation Different men attach very different meanings to the terms overtopped and dominated One man will call a tree dominated if there is another tree six feet higher within some yards of it, while another man will wait until the tree is completely smothered between the surrounding crowns. Hence a person or school belonging to the latter class would be perfectly correct in saying that the removal of dominated stems can have little or no effect on the growth of the crop, while a person or school belonging to the former class would have a tendency to make a thinning *par le haut*, and call it one *par le bas*. This state of affairs, when reduced to a paper discussion far from the forest is bound to lead to divergencies of opinion, which however are far from undesirable, so long as we do not get excited over them.

As regards the merits of the rival systems, *par le haut* and *par le bas*, I must confess myself in the present state of my knowledge, an adherent of the Nancy School so despised of Mr. Fernandez. If a tree is really dominated, I fail to see that its removal can do more than enable the surrounding trees to lower their crowns, to throw out epicorms, and to make increase of girth at the expense or height. Now Mr Fernandez will probably admit that in the earlier life of a timber tree height is even more important than girth. Mr Fernandez considers it bad management leaving suppressed stems to die or nearly die. But what is done in a thinning? Mr Fernandez will probably again admit that it is the admission of light into and through the crowns—*vide* figures above discussed. If the thinning is made *par le haut*, *inter pares*, this light is taken up by the suppressed stems and by them converted into firewood. If the thinning is made *par le bas* it is either no thinning, or the light reaches the soil, and expends its energy in the production of grass and shrubs, to say nothing of epicorms. Hence the faith that is in me.

One more point to finish with. I really must deprecate the disrespect with which Mr Fernandez treats the editorial *We*. Old subscribers can appreciate Mr Fernandez' services, but the unregenerate might say he learnt now little respect is really due to an Editor at the time when he was *We*, somewhere about 1889.

F. GLEADOW.

The Dimensions of Trees.

Your comparison between the heights of St Paul's Cathedral, the spire of the dome of Cologne and the *Eucalyptus amygdalina* are extremely interesting, but whereas the heights of those buildings are correctly known that of the tree is to say the least, problematical. No doubt Baron Von Mueller in some of his earlier publications claims the enormous length quoted for some of the trees measured by him but it is generally understood in Australia that those measurements were made of old fallen trees, portions of which had been destroyed by bush fires, and it is considered quite feasible that in this way the trunk of one tree and the crown of another supplied the data, the intervening portion being added as destroyed by fire

The fact remains that, so far as I am aware, the extreme proportions quoted have never been found to exist by Forest officers of the Colonial Governments who examined the forests, though some of the mightiest kings of the forest have been carefully preserved by them. The measurements of Big Ben, or Big Bob, I am not sure which, growing in the Melbourne water-supply reservoir, and which is considered the king amongst the lords of the forests, are well known I forget what they are said to be, but as given to me they fall far short in length of those quoted in your extract, which, failing further verifications of their accuracy, cannot be accepted as authoritative

A FORESTER

10th December 1896.

The Official Designation of Forest Subordinates.

I suppose the reorganisation of the Subordinate Staff cannot be much longer delayed If I remember rightly, it was contemplated to increase the number of classes, including, for example, "Deputy Rangers" May I be permitted to suggest that there is no necessity for this and not only so, but that the time when the reorganisation is effected is a good one for reducing one of the three classes we have already There appears to be no object in having ' Rangers," Foresters," *and* 'Forest Guards." Rangers and Foresters do the same work, they hold Ranges If it is contemplated to sometimes put Foresters in charge of large depots instead of Ranges, the name ' Forester" is no more suitable than that of Ranger' Moreover, it often happens that extra big depots would be held by Rangers, and similarly extra small depots are often held by Forest Guards I maintain there is no use in retaining more than two classes, anything for simplicity in these complicated days For choice I would omit the name "Forest Guard" (which has been borrowed from the French); "Ranger" and "Forester" are old English words, and convey their meaning well Who has not heard of the "King's Foresters?" They were "keepers," the nearest approach to the "Forest Guard" of to-day. The uninitiated do not understand the name "Forest Guard," the native name in these parts is "patrol," while Europeans often talk of them as "Foresters." A "Forester" again in these parts is called "Ranger-ji"—or to be accurate "Rager-ji," or Razor ji" Of course, it is a small point, but while one is about it, why not adopt a well-sounding nomenclature and one in accordance with tradition.

MILES.

IV.—REVIEWS

The Forest Administration Report of the Jammu and Kashmir State for 1895-96.

The report under review deals with the fifth year of Mr. McDonnell's administration of the forests of the Kashmir State. That good progress has been achieved during that period is evidenced by the following extracts

“Now that a period of five years has elapsed since the Conservator
‘assumed charge of the Kashmir State Forest Department,
‘it will perhaps not be out of place to take a retrospective
‘view and see what has been done during that time At the beginning
‘of the work there were no records to show even where the
‘forests were situated, and it was for some time a groping in the
‘dark or rather a series of voyages of discovery made by the Conservator
‘himself to every part where he was told forests existed ;
‘he has now been nearly everywhere and the position of the forests
‘is roughly noted on the map besides which a rough description
‘of the tracts visited has been made and printed ”

“No one could hazard a guess even as to the area under forest,
‘now every Annual Report gives a detailed estimate of the areas,
‘and this, though a rough and probably incorrect one, is decidedly
‘better than nothing From the foregoing it will be apparent that
‘no attempt had been made in previous times to demarcate the forests,
‘so that this great and important work had to be begun as
‘soon as possible It is not necessary to dilate on the many obstacles
‘that had to be overcome, nor on the opposition experienced
‘on all sides , suffice it to say that the Department never stopped
‘the work once they put their hands to it and from nothing the
‘area marked out as forest property now stands at 179 63 square
‘miles fully and 340 61 square miles partially (lower boundary)
‘demarcated by means of posts at convenient distances, with also
‘a 10-foot line cut wherever necessary, and this was achieved at a
‘cost of Rs 3,702 in all Nor is this the sum of what has been
‘done to rescue the forests from the encroaching and destroying
‘hand of the villager and ruthless trader , for of the area demarcated
‘a boundary survey has been made round an area aggregating
‘367 95 square miles, at the small cost of Rs 1,225 , that is to say,
‘for the moderate outlay of Rs 1 927 expended on demarcation
‘and survey 367 95 square miles of forest land have been secured
‘against the destruction that was daily and hourly going on before
‘the Conservator appeared on the scene ”

“What forms this destruction took has been frequently described
‘in former Annual Reports , the worst were, barking trees
‘(even deodar) for roofing houses and tanning, hacking into green
‘trees for torchwood, felling hundreds of young conifers to feed
‘goats and sheep, using hundreds of fine young deodars of 20—30

‘years old to build village houses, and so on. Perhaps the
‘most grotesque form of waste was the one which the Conservator
‘noticed at the first depôt he visited, *viz*, that splendid first
‘and second class deodars were being cut into short logs to be sold
‘in the city of Srinagar for *firewood*, and that, too, when every
‘cubic foot could be sold in the plains at ten times the price ob-
‘tained. Most of these forms of damage may be said to have
‘ceased entirely, others occur only here and there. Now no more
‘deodars are given for buildings, since the blue pine and other
‘conifers are quite good enough ; this alone is a vast saving to the
‘forests.”

“The depôts were simply huge heaps of logs of all sizes and
‘shapes ; now they are arranged in exactly the same manner as are
‘those of the Punjab Forest Department , this put a stop to all
‘sorts of irregularities which need not be gone into here, and re-
‘sulted in higher prices for the timber when sold.”

“The accounts have been modelled on those of the Imperial
‘Forest Department, whereas formerly they can hardly be said to
‘have been accounts at all strictly speaking ; to the initiated these
‘two reforms will convey more than appears in these few words,
‘and the present results were not attained without much hard
‘work and difficulty, as can readily be imagined ”

“Taking the revenue side of the question also, the Department
‘can point to satisfactory progress The accounts available prior
‘to Sambat 1948 (1891 92) summarised in Diwán Amar Náth’s
‘Report at page 17 give a total of Rs. 6,13,095 net profit for ten
‘years , to this should be added Rs 1,90,000 assumed to be the
‘surplus for Sambat 1947, making in all eleven years, plus the
‘amount (Rs 7,47,254) since realised from the account of Ganesha
‘Mal, the total is 15½ lakhs of rupees, but the corresponding profit
‘obtained during the past *five* years amounts to close upon 19
‘lakhs (Rs 18,95,642) In the matter of revenue outstandings
‘the Department has also done well, for it has managed to get in
‘not far short of one lakh of rupees during the five years in ques-
‘tion. So also as regards amounts outstanding against contractors
‘and disbursers ; four years ago the total stood at three-quarters of
‘a lakh ; at the end of the year under review it was reduced to
‘Rs. 25,000, and that too when the work is beyond comparison
‘greater than in former years ”

“As regards the establishment, it is only necessary to say, as
‘regards the rank and file, that from a useless horde of men who
‘drew pay and did little or no work, many of them sitting in their
‘homes and only appearing to draw their pay, the Department
‘now has an organization which is yearly improving, and every
‘man has his beat duly marked out for him. In short, there
‘has been good progress in a short time under great difficul-
‘ties, and the Forest Department is now one of the paying ones
‘in the Jammu and Kashmir State.”

The total area under forest at the close of the year was estimated at 1,608 square miles, of which 418 square miles contain deodar and it is said that this area is not likely to be increased in the future. There seems to be a regretable want of harmony between the Forest and Settlement Departments, and the Conservater complains that the latter has included large areas of valuable forest within the village boundaries and has further given grants of land within forest limits

As regards the general protection of forests, we are told that ‘the number of new cases in all districts instituted during the year was 504 As is always the case, the majority of these 382, were for unauthorised felling of trees this is less than the previous year, when the figures were 705 and 538 respectively and this is probably due to better supervision though it is as yet too soon to build any theories on figures The number of fire cases is less than last year, being 60 against 82, but it is formidable enough At the close of the previous year there were 667 court cases pending and one of compensation the former with the 504 new cases gives a total of 1,171 court cases for the year Of this number only 476 were disposed of during the year or 40 per cent —a very bad state of affairs—even worse than the previous year which though bad enough still showed a total of 574 cases finished This leaves at the end of Sambat 1952 the enormous number of 695 court cases pending Convictions were obtained in 239 of the cases disposed of, this gives 50 per cent, against 57.6 per cent of the previous year, so in every way is there a falling off ”

It is not stated whether any special measures were taken to exclude fires but the forests seem generally to have escaped burning, except in the Bhimbar and Udhampur districts, where fires ran through 30,000 and 3,000 acres of chir forest respectively With regard to these Districts, the Conservator remarks —

“It is hopeless to expect a decrease in the number of fires here, while the present system of grazing management being controlled by the Revenue Department continues, the officials who manage it do not care how much forest is burnt, as long as they get their revenue nor do they take the slightest pains to prevent wandering Gujars from setting fire to the gras, nor will they give any help to the Forest Department in preventing or putting out fires ”

‘ In Bhimbar the fires were incessant and sweeping Most of them were caused by the villagers deliberately setting fire to the grass, but others swept over from the Poonch jágír Here again the people are emboldened by the lenity shown by Magistrates in dealing with such cases The Forest establishment did their best to stop the fires, but the season was an exceedingly hot and dry one and in the face of furious winds from all directions little could be done To show how the Bhimbar Magistrates 'deal with fire cases, it may be mentioned that the Forest 'Officer caught a man in the act and sent him up for trial to the 'Tahsildar of Naoshera, who let him off with a nominal fine of 'eight annas! In Kotli also this Tahsildar merely awarded nominal 'fines in cases fully proved to the satisfaction of the court. 'In all 30 fires occurred and 25 prosecutions were entered. It 'is not possible to estimate accurately the area traversed by fires, 'but it is roughly computed at about 30,000 acres. Of the 30 'fires no less than 16 happened in the Kotli tahsil Unless the 'State Government take the matter up strongly and insist on District 'Officers aiding the Forest Department and that Magistrates 'should award adequate punishments, there is little chance of 'improvement in this district; the areas involved are too vast for 'the Forest Department by itself to hope to prevent fires caused 'by deliberate action on the part of villagers"

Deodar seeded profusely in 1894-95, "and hopes were entertained 'that a great number of seedlings would be found in the 'spring; this hope has been realised, and it is not too much to 'say that a finer show of healthy deodar seedlings could not be 'found anywhere than was to be seen in the deodar forests of 'the Kashmir valley early in the spring of the present year '(Sambat 1952), and much the same condition is reported from 'other parts of the State The number of plants that have survived 'over that year into (Sambat) 1953 is simply astonishing; 'in many places in the Drogmula and Lolab forests they are exceedingly 'numerous; strong and healthy plants 4 to 5" in 'height being found in great numbers In fact, the re-stocking of 'these forests may be said to date from the year under review, 'and as in Kashmir, at any rate, there is little or no danger from 'fire, while cattle grazing does practically no harm, there should 'be few casualties among the plants Goats and sheep are not allowed 'to traverse the forests where the best new growth has been 'observed As might be expected after such a year, the seeding 'in the year under notice was very scanty, both of deodar and 'blue pine'

The amount of timber removed from the forests was, exclusive of waste material:—

	Cub. feet
By State agency	1,494,426
"Purchasers"	1,199,423
Under free grants	645,884
Total ...	3,339,733

But it is not possible to gather from the report how much of this was deodar and how much other kinds.

The average price of deodar timber was Rs 0-7-0 per cubic foot on the Jhelum and Rs. 0-9-5 per cubic foot on the Chenab, first class timber fetching as much as Rs 0-11-2 on the Jhelum and Rs. 0-13-0 on the Chenab

The revenue of the year was Rs 7,91,690 and the expenditure Rs 2 55,330, leaving a surplus of Rs 5,36,360 Both the gross revenue and the surplus were the largest yet obtained, which was principally owing to the sale of an additional lakh of sleepers which 'by the exertions of the Department were suc'cessfully cut, delivered and sold It should, however, be stated 'that the successful delivery was partly due to the fact that the 'River Jhelum behaved very well, and there were no destructive 'floods which might have caused great loss, it was an anxious 'time, but success was achieved It is ordinarily the custom not to 'launch sleepers between May and September, so that it was 'somewhat venturesome to go on launching all the season"

With the exception of some 159 acres of linear valuation surveys, nothing seems to have been done so far in the way of collecting data for working plans, and it would be interesting to know what prospect there is of the present rate of extraction being maintained.

VI-EXTRACTS NOTES & QUERIES

The Grievances of the Forest Department.

The latest orders regarding the grant of extra pensions to Forest officers as conveyed in Secretary of State's Financial despatch No 109, dated the 9th July, limit the concession to an extra pension of Rs 1,000 per annum to officers who have rendered not less than three years' approved service as Inspector-General, or as Conservator, 1st grade, that is to say, seven officers out of a total strength of 208 are rendered eligible for the extra pension. As the decision has caused a widespread feeling of discontent among all officers of the Department and has given them reason to feel that they have not been fairly dealt with, and that the plain promises of the Secretary of State have not been fulfilled, we propose to give a short history of the case, and to state the grounds on which Forest officers are now so generally dissatisfied.

They claim to be placed on an equality, as regards their pension rules, with officers appointed from England to the Public Works Department during the same period Now officers of the Public Works Department appointed previous to the receipt in India of the Secretary of State's despatch above quoted (*i e*, the 28th July 1896) are eligible for the pensions regulated by Articles 712 and 714 of the Civil Service Regulations Under the latter Article special additional pensions over and above those allowed in

Article 712 may be granted as rewards of approved service in the high and responsible positions referred to below :—(*a*) Additional pensions of Rs 2,000 per annum to those who have served three years as Chief Engineers, or officers who have been graded as such; (*b*) Additional pensions of Rs 1 000 per annum to those who have served three years as Superintending Engineers Under these rules 105 officers out of a total strength of 592 (this being the total number of officers on the Imperial staff in 1893), that is to say, 17 7 per cent may become eligible for these extra pensions Forest officers, therefore, who were appointed from England previous to 28th July 1896 claim that such of them as rise to high and responsible positions corresponding to that of Chief Engineer and Superintending Engineer, should be admitted to the same pensionary benefits as are enjoyed by their contemporary brother officers in the Public Works Department The position of Inspector-General of Forests is as high and responsible a one as that of Chief Engineer, and the position of Conservator is as high and responsible as that of Superintending Engineer Forest officers claim, therefore, that special additional pensions of Rs 2 000 per annum ought to be granted to officers who have rendered not less than three years' service as Inspector-General of Forests, and an additional pension of Rs 1,000 per annum to officers who have rendered not less than three years' approved service as Conservator of Forests This concession, if granted, would render 20 appointments out of 208, *i e*, 9 6 per cent, eligible for additional pensions as against 17 7 per cent, as hitherto obtaining in the Public Works Department

Now as to the causes which have led Forest officers appointed from England to consider that they are entitled as a matter of justice to be placed in all respects on an equality with their contemporary brother officers of the Public Works Department The following are the main reasons which have led them to hold this opinion —I Officers of the Forest service are of the same social position and are trained at the same college as the officers of the Public Works Department II The Secretary of State in his Financial despatch No 310, dated 10th August 1876, stated that the trained officers of the Forest Department occupied a closely analogous position to officers of the Public Works Department III From time to time various concessions made to the Public Works Department have also been extended to the Forest Department IV The Secretary of State has placed Forest officers appointed after 1893 on exactly the same footing as their contemporaries in the Public Works Department If any difference exists between the services, therefore, it must have existed before and not after the 21st September 1893, because the Secretary of State in his despatch No 188 of that date places officers thereafter entering either service on precisely the same footing What change in the constitution of the services or in the claims or responsibilities of these officers in the higher grades took place then or thereabouts? The services in India are ignorant of any. V. The Public Service Commission specially appointed in 1889 to enquire into and report on the conditions of the different Departments in India, recommended, in the case of the Forest Department, that the conditions of service as to leave and pension should be assimilated to those of the Imperial Branch of the Public Works Department VI The Government of India fully approved of the recommendations made by the Public Service Commission, and has no less than five times under three different Governors-General, and with entirely differently constituted Councils, urged upon the Secretary of State the advisability of placing home-recruited officers of the Forest Department on an equality with similarly appointed officers of the Public Works Department, moreover, it was for the Forest Department alone out of the many departments whose claims were under consideration that this step was recommended These are only a few of the many considerations which influence Forest officers and others in thinking that their claims have not been adequately recognised by the Secretary of State

An additional reason why Forest officers feel that they have not been fairly dealt with is that for some considerable time they remained under the impression that their claims had been acceded to and that the recommendations made by the Public Service Commission which had been so many times urged by the Government of India had actually been given effect to Thus Para 17 of the Official Regulations for the Forest Service Branch of the Royal Engineering College, Coopers Hill for 1894 contained the statement "The more favourable pension rules have recently been extended to Forest officers appointed from England who are thus placed on an equality with Public Works officers appointed from Coopers Hill College" This statement undoubtedly deceived the service in India "The more favourable pension rules" were notoriously those enjoyed at the time by Public Works and Telegraph officers No favourable rules, the extension of which to Forest officers would produce "equality," exist other than these contained in Chapter XXIX, Section III, of the Regulations, including Articles 712 and 714 No other inference can possibly be drawn from the paragraph as it stands, than that Forest officers had been granted the same pensionary benefits as hitherto enjoyed by officers in the Public Works Department. For in it there is nothing whatever to show that only a portion of the more favourable rules, *viz*, these under Article 712 had been extended to them, whilst those under Article 714 had been withheld.

Again, the Secretaty of State in his despatch No 188, dated 21st September 1893, writes "I sanction the extension of the scale of pension now granted to the covenanted offices of the Public Works and Telegraph Departments to officers appointed from England to the Forest Department." Again the Secretary of State in the same despatch, and in his No. 230, dated December

26th, 1895, has stated that Forest officers who have rendered not less than three years' approved service as the Heads of the Department in any Province are eligible for an additional pension of Rs. 1,000 per annum. This statement he also made in Parliament in answer to a question put by Sir Richard Temple on the 31st July 1894 Conservators of Forests of all grades are Heads of the Department in their various Provinces The duties and responsibilities of a Conservator of Forests are the same, be he of the 1st, 2nd or 3rd grade. The most important Provinces may be held by Conservators of any grade, and are, indeed, owing to the paucity of these appointments not often in the charge of a Conservator of the 1st grade. For example, the four Conservatorships in Burma, which are the most important in the service from a Revenue point of view, as well as perhaps the most trying physically, are at the present moment held as follows :—

Province.	Circle.	Rank of Conservator in charge.	Revenue realized during the year 1895-96.
Lower Burma	Tenasserim	Offg. 3rd grade	17,76,000
Do.	Pegu	3rd grade	16,39,000
Upper Burma	Eastern	Offg. 3rd grade	15,75,000
Do	Western	Do. do.	7,06,000

If Conservators of Forests of the 1st grade only are Heads of the Department, then in Burma, the most important of all Forest provinces, there is no Head of the Department at all. It may here be noted that it was not until the publication of Government of India Resolution No 2958 P., dated 22nd June 1895, in which the Inspector-General was alone made eligible for an extra pension of Rs. 1,000 a year, that any doubt was felt but that, as apparently promised by the Secretary of State both in Parliament and his despatches No 188, dated 21st September 1893, and 230, dated 26th December 1895, and as publicly notified in para. 17 of the Coopers Hill Prospectus for 1894 and 1895 the benefits of Article 714 were to be extended to all trained Forest officers Even then, the Department awaited with confidence the publication of the further orders regarding the Forest Department, promised in para. 2 of the Resolution above referred to It was not until the publication of Government of India Resolution No 3597 P., dated 21st August 1896, that the Department became aware that the extra pensions had been restricted to the Inspector-General of Forests and to Conservators of the 1st grade, of whom there are but six, out of the total controlling staff (as it stood on the 1st January 1896) of 208 officers.

Where, then, is the equality with officers of the Public Works Department which we have been told now exists? As a mater of fact, it exists only in the case of officers appointed after the issue of the orders of 21st September 1893, while officers appointed before that date do not in any sense enjoy the some pensionary benefit as their contemporaries in the Public Works Department, as they had been led to believe they would do. And it is not to be wondered at that officers throughout the service are discontented at the way in which the Department has been treated by the Secretary of State, inasmuch as statements have been made in the Coopers Hill Prospectus, in his despatches, and in the House of Commons which have not been carried out. On what grounds can the Inspector-General of Forests and Conservators of Forests, 1st grade, be considered as the only Heads of Department? The Inspector-General of Forests is not a head of a Department at all, but is attached to the Government of India to assist it in the Forest business which comes before it. And if Conservators, 1st grade, are Heads of Department, as they are, so then are Conservators of the 2nd and 3rd grade also. A fact may here well be noticed which renders the refusal of the Secretary of State to extend the full benefits of Article 714 to the Forest Department, particularly galling, *viz.*, that under Article 704 natives of India of purely Asiatic descent appointed in India to the Public Works Department may become eligible for the full benefits of Article 714, which benefits have been but partially extended to Forest officers appointed and trained in England.

Owing to the unhealthy climate in which Forest officers are for the most part obliged to perform their duties, but few officers have any chance of earning the extra pension now sanctioned for Conservators of the 1st grade. This rank will be reached by but few officers, and in future hardly ever before an officer is 50 years of age, and the death rate prevailing amongst Forest officers is a high one. It may be noted that out of 22 trained officers posted to Bengal previous to 1895, the average length of service being at present 10 years, five, *i. e.* 22.72 per cent have died, so that less than one-third are likely to reach 30 years' service. In Burma out of 37 officers, with an average service of 10½ years, seven, or 18.91 per cent have died, so that the chances are that less than half the men appointed will reach 30 years' service. In Assam 20 per cent., with an average of 6¼ years' service have died. Taking all the Provinces of the Bengal Presidency together, out of 94 officers recruited up to the end of 1895, nineteen, *i. e.*, 20.22 per cent. have died, the average length of service being 12¾ years, at which rate only half the staff have a chance of reaching 30 years' service. These figures do not take into consideration causes other than death, such as early retirement on account of ill-health, &c., which have been numerous. The difficulty of obtaining a pension at all, let alone a special one, in the Forest Department, will be realized when it is noted that out of 128 officers who have left the Department, 56 have died, 28 resigned, frequently owing to ill-health, 12 retired on medical certificate and only 32, or 25 per cent obtained an ordinary pension. The cost of the concessions now asked for will not, it is believed, average more than Rs. 15,000, or at the existing rate of exchange, £891 per annum. In this connection attention may be called to the following figures showing the large increase which has taken place in the Forest revenue and surplus during the period 1873-74 to 1893-94, an increase which the officers to whom the India Office now denies the small pensionary concessions claimed, have succeeded in creating.—

		Revenue.	Expenditure.	Surplus.
1873-74	...	66,62,565	41,88 387	24,74,178
1883 84	...	1,08 54,882	67,06,890	41,47,992
1893-94	.	1,77,13,020	93,40,700	83,72,230

It will doubtless be acknowledged that the Forest officers have a strong case, and that when their petition signed by every trained officer on the Imperial Staff comes to be presented, as it will be shortly to Parliament, they will be entitled to full consideration at the hands of that assembly.—*Englishman.*

The Formation of Sand Dunes.

At the meeting of the British Association at Liverpool, Mr. Vaughan Cornish contributed one of the most valuable and original papers read to the Section, in the form of a practical study of the formation and distribution of sand dunes. He said that in the sorting of materials by wind the coarser gravel is left on stony deserts or sea-beaches, the sand is heaped up in dune tracts, and the dust (consisting largely of friable materials which have been reduced to powder in the dune districts itself) forms widely-scattered deposits beyond the limits of the dune district Three principal factors operate in dune tracts, *viz* (1) the wind, (2) the eddy in the lee of each obstacle, (3) gravity. The wind drifts the fine and the coarse sand The upward motion of the eddy lifts the fine sand, and, co-operating with the wind, sends it flying from the crest of the dune The backward motion of the eddy arrests the forward drift of the coarser sand and thus co operates with the wind to build the permanent structure of the dune Gravity reduces to the angle of rest any slopes which have been forced to a steeper pitch either by wind or eddy, hence in a group of dunes the amplitude cannot be greater than (about) one-third of the wave-length. This limit is most nearly approached, owing to an action which the author explained, when the wind blows alternately from opposite quarters Gravity also acts upon the sand which flies from the crests, causing it to fall across the stream lines of the air To the varying density of the sand-shower is due the varying angle of the windward slope of dunes When there is no sand shower the windward becomes as steep as the leeward slope. When the dune tract is all deep sand the lower part of the eddy gouges out the trough, and, when the sand-shower fails, the wind by drifting and the eddy by gouging, form isolated hills upon a hard bed In a district of deep sand, negative dunes (" Suljes ") may be formed. The encroachment of dune tract being due not only to the march of the dunes (by drifting), but also to the formation of new dunes to leeward from material supplied by the sand-shower, it follows that there is both a "group velocity" and a "wave velocity" of dunes Since the wave velocity decreases as the amplitude increases, a sufficiently large dune is a stationary hill, even though composed of loose sand throughout Where material is accumulated by the action of tidal currents, forms homologous with the ground plan of dunes are shown upon the charts. The vertical contours and the movements of subaqueous sand dunes are conditioned by the different tactics of sand-shower and sand-drift.—*Nature.*

Wealth based upon Elastic Gum.

The latest advices from Para, the greatest rubber mart at the mouth of the Amazon, are that more rubber has arrived there from the interior since July 1st, the beginning of the crop season, than in the same period of any preceding year All records in rubber production in Brazil were broken in 1895, but it would not be surprising if the output should be still greater this season ; so that no fear need be entertained of a lack of rubber for bicycle tyres, or any of the thousand and one other modern uses for this wonderful gum. It is a singular fact that the yield of rubber from the Amazon valley has increased, almost without exception, in every year since 1839 All this time the work of exploring the tributaries of the Amazon has been going on, opening to navigation the world's greatest system of waterways, and, as every stream in that section is lined with rubber trees naturally the gathering of gum has increased There has also been developed a spirit of enterprise which gives promise of continued activity in the rubber trade A dozen new steamers have been ordered within a year for navigating the Amazon and its branches, their principal purpose being to convey to market the ever-growing rubber crop, and to carry on their return an equal weight of merchandise obtained in exchange for it Lately 1,300 miles of telegraph cable have been laid in the Amazon between Para, the seaport, and Manaos, the capital of the neighbouring State up the river, and its chief reliance of income is the rubber traffic.

Ninety-eight per cent of the revenues of the State of Para come from the export duty on rubber amounting to 21 per cent. of its value At the present price of fine Para rubber the State collects 15 cents per pound as its share. With the development of the rubber trade, the formerly insignificant village of Para has grown to be a city of 100,000 inhabitants, with several daily newspapers, eight banks, electric lights, street railways, which last year carried 10,000,000 passengers, the finest theatre in Brazil and beautiful parks, all the direct results of the trade in rubber. And Manaos, up the river, the rival of Para in the rubber trade, is undergoing a similar transformation, although the population is not yet so large New York capitalists are now putting up an electric lighting plant in Manaos, and other modern improvements are gaining a foothold in this old Indian village which has become the capital of a State greater in extent than any in Uncle Sam's big family

Thus it will be seen that rubber is the main stay and support of the Northern Brazilian States, both of the Governments and of the population, and the foundation of all municipal and commercial growth and of internal improvements of whatever character The same thing is true of Bolivia and Eastern Peru, whose rubber output is floated down the Amazon to the seaboard, being credited in the end to Para There would appear to be more reason for the veneration of the rubber tree by the natives of Brazil than by the Abors on the northern frontier of British India, according to whose mythology their rubber tree is the abode of a great and powerful spirit, whom they seek constantly to conciliate But, while the people who regard the rubber tree as sacred will protect it at the risk of their lives, although it serves them no useful purpose, the Brazilian rubber gatherer has to be restrained by law from recklessly destroying the tree which yields his principal support

But the countries named are by no means the only parts of the world that are being developed by the rubber traffic The towns of Accra and Lagos on the west coast of Africa, are attaining new importance from the same cause The expected traffic in rubber is one great incentive to the building of the Congo railway, already half completed The search for rubber is leading to the fuller exploration of Burma Altogether, rubber is proving a great factor in civilization, being besides ivory, the only commodity produced in the interior of any tropical country that will bear the expense of transportation to the seaboard Thus it has been in many places the basis of the first commerce and the first transportation systems, opening the way to a diversified and more extensive traffic Having served this useful purpose, the crude rubber, in the hands of the chemist and manufacturer, changes into forms which enter into every phase of life and have a bearing upon every branch of human endeavour Without the rubber tyre, we should not have known the bicycle as it now exists, with its far reaching influence on health, manners and morals in every land, for it seems as if the bicycle would come into general use even in places where the wearing of clothes has never become popular. Yet, important as is the use of rubber for tyres, probably not more than 4 per cent. of the total consumption of rubber is handled in the bicycle trade. To master the details of its other uses would be equivalent to a liberal education.

The rubber of Brazil, gathered from trees which are native to no other countries, is so far superior that for many purposes other grades of rubber do not come into competition with it. It is in demand for tyres, for insulating electric wires, except for ocean cables, which are covered with gutta-percha, for waterproof clothing, the best rubber shoes, medical and surgical goods, erasers, etc., while the African and Asiatic rubbers are available for cheaper foot wear, door mats and some of the mechanical goods, such as hose, belting and packing for steam valves. Strange to say, English-speaking people have known this gum for more than a century as India rubber, although the most important supplies have always come from Brazil. The total output from British India from the beginning probably has not exceeded in weight the rubber now floated down the Amazon in a single year.

The following table of the world's productions of rubber for 1895, which has not been published, is compiled, to an important extent, from official sources. Where round numbers are used, they are based upon estimates believed to be too low rather than too high:—

America.	*Pounds.*
Mexico	160,802
Central America	2,000,000
Brazil	46,363,000
Other, South America	3,500,000
Africa.	
Gold Coast Colony	4,022,385
Lagos	5,060,504
Congo basin	1,406,513
Angola	4,000,000
Portuguese East Africa ...	500,000
German Africa	1,400,000
Madagascar	1,000,000
Other countries	2,500,000
Asia.	
Assam and Burma	1,000,000
East Indies	500,000
Total ...	73,413,234

As rubber has become more valuable, many chemists have attempted to produce artificial rubber, but without success as yet. But manufacturers have learned to extract rubber from worn-out goods, so that every cast-off rubber shoe or bicycle tyre is now readily saleable for cash, for the manufacture of what is known as reclaimed rubber Likewise the fear that the native forests might sometime become exhausted has led to numerous projects for the cultivation of rubber.

The British Government, alive always to the development of the resources of its colonies, becomes interested in the subject of establishing plantations of rubber in India, after certian experiments with rubber trees at the Royal Botanical Gardens had given promise of success. The first thing sought was to procure the best varieties from the Amazon valley, for which purpose a commission was given to Clements R Markham, afterwards President of the Royal Geographical Society, whose success earlier in introducing the cultivation of Peruvian bark into Ceylon and India had revolutionised the production of quinine, and led to the abandonment of the cinchona forests in the Andes. Dr. Markham personally visited the South American rubber forests, and with the assistance of eminent British botanists. procured plants and seeds, under circumstances which added to the world's knowledge of rubber-bearing species and of the geography of Brazil. The result was less satisfactory than in the case of cinchona plantations, especially as the interest felt by the Government did not survive the long interval required for the Para rubber trees to become productive. There are now, however, in various parts of the Indian empire, groups of South American rubber trees, including 635 acres of 'plantations' on the island of Ceylon, from which a small first lot of gum was gathered last year for export. There has been a revival of interest in rubber in Ceylon, where, by the way, there are no indigenous rubber species of value, and many planters have been buying and planting Para rubber tree seeds, which are now included regularly in the price lists of the local nurserymen

But the most important outcome of all these experiments is the Government plantation of the native rubber tree of India, established in 1873 at Charduar, near the Brahmaputra river, in Northern Assam and a smaller one at Kulsi, in the same country. From a small beginning these plantations have been increased from time to time until they embrace two thousand acres. The trees first planted are now old enough for tapping, but as yet only a small amount of rubber has been produced, the first care being to produce vigorous trees. Among the many drawbacks to the maintenance of the plantations have been the ravages of wild elephants and deer, the one trampling down and the other feeding upon tender young trees, and also surreptitious tapping by natives more interested in a present pound of rubber than in the future welfare of the trees. The net result of the Indian experiments has been the demonstration that with little labor rubber trees may be grown from planted seeds, and that they will yield as well as native trees. But there are many ways of making money quicker, while the extent of the known rubber forests which remain untouched has prevented most capitalists from giving serious attention to rubber cultivation.

In addition to the maintenance of the Charduar plantation, the Government of India has manifested its interest in rubber by extending its care of the forests in general to rubber in particular, by attempting the enforcement of regulations against cutting down the trees and against the collection of rubber by any method, excepting during certain months. As a feature of the system of regulation, licenses to gather rubber are sold by Government, and all persons other than the licensees are forbidden to go into the forests for rubber. Such regulations, of course, cannot be enforced among the tribesmen inhabiting the northern boundary of Assam, where the trees are gradually disappearing. But as the product credited to Assam thus shows a falling off, that of Burma increases through fresh discoveries of trees, so that, for a long term of years, the total product of rubber from British India as a whole, has scarcely varied one year from another.

Attempts at rubber cultivation on the Western Hemisphere have been more numerous, but more sporadic. Señor Don Matias Romers, who has been so long the Mexican Minister at Washington, wearying at one time of public life, retired to his native State of Chiapas and started an extensive plantation of rubber, but his vacation from office holding was brief, and the rubber trees planted by him did not thrive under the succeeding owner. More recently several plantations have come into existence as the result of a subsidy offered by the Mexican Government. The largest of these in the State of Oaxaca, contains 200,000 trees eight years old. An American engineer named Harriman settled in Tehuantepec several years ago and began experimenting with rubber trees for supplying the shade needed in the coffee plantations there, with such success that he has entered extensively into the growth of rubber and coffee together, this work having found imitators as far away as Ceylon. In Costa Rica, a Brooklyn man named Miror C. Keith, engaged in railroading, has won two large cash prizes offered by the Government to encourage rubber cultivation. In most of the Central American States steps have been taken by the Governments either to protect existing forests from the destruction with which they were once threatened, or to encourage the planting of more trees The President of Nicaragua recently issued a decree prohibiting the gathering of rubber, save from plantations or privately owned lands, for ten years from January next. In Columbia some small plantations exist, and even in the Brazilian State of Para a law has been passed providing a reward of $546 (paper) for every 2,000 rubber trees planted. But all plantations growing out of these public measures are of too recent date for any important amount of rubber to have been produced from them.

A recent report from the British Foreign Office on rubber cultivation in Mexico estimates that the first year's yield from a plantation of 100,000 trees will bring a net profit of $95,000, after deducting the entire cost of the land and all expenses up to the first year of harvesting while each of the succeeding harvests for twenty five or thirty years will bring a steady net income of over $100,000 The amount of land required would be 520 acres, and bananas and other crops could be grown between the trees for a few years, the possible profits from which are not taken into account in the above estimate But people with money to invest are too apt to be deterred by the length of time required for a rubber plantation to be productive to take stock even in a concern promising such heavy profits, although oranges and many other fruits, coffee, tea, etc, do not yield cash returns much more promptly

A more attractive prospectus can be gotten up for a company to "exploit' existing rubber forests At this time an American syndicate is seeking capital to develop a concession covering 10 000 000 acres of lands in the Orinoco Valley, one expected source of profits being in the virgin rubber forests known to exist there The subject of developing the Venezuelan rubber has at times engaged the attention of no less important personages than the Rothschilds, so that it will not be strange if less astute investors contribute funds toward this development In London papers have been advertised lately the shares of a company with $1 000 000 capital, organized by a Frenchman, operating from New York, to gather rubber in a hitherto unexplored field in French Guiana So it will be seen that opportunities exist in this trade for the promoter and speculator as well as for the buyer and seller of rubber as a commodity. It has ever been so since the days of the London Caoutchouc Joint Stock Company which proposed to extract rubber from the mulberry trees of Assam and apply it to silk spun from cocoons gathered from the same trees using as a solvent for the gum the naphtha from neigbouring wells, the idea being to produce beautiful waterproof stuffs without leaving one's tracks as it were There were great days too, for the rubber promoter immediately following Charles Goodyear's inventions in rubber, when the increased demand for gum led to a rush of prospectors to the Amazon Valley, where they created a ' boom" and were ruined by its collapse

The United States having been from the beginning a larger consumer of rubber than any other country, the question of a home supply of the raw material has often been discussed. But not even during the period when there was a tariff on crude-rubber imports did any practical step towards rubber production take shape There is, indeed, no reason to believe that the conditions of temperature, moisture, soil, &c., which exist in the home of the best rubber trees—say in the Amazon Valley or in India—are to be found anywhere in the United States. Where the Brazilian rubber tree flourishes, orchids bloom in profusion in the open air, the climate being in effect, that of the interior of the hot houses in which our florists rear tropical plants. While there have been articles in the Florida newspapers of late about growing rubber trees, it is asserted by one of the best informed men in the trade in New York that there is no probability that such trees would flourish in that State any better than olive trees would on the metal roof of the Tombs prison. Wherever one of the many rubber species is indigenous, the tree may be grown as well from seeds planted by man as from those scattered by winds, and the product of one will be as rich in its quality of rubber as that of the other, but it requires something more than intense summer heat for brief periods to fit the United States for producing rubber.

HAWTHORNE HILL.

—*Scientific American Supplement.*

Wood-Paving in Rangoon.

A note written by Mr. Stirrat, Engineer to the Municipality says:—On 17th March 1896, the Public Works Sub-Committee recommended that a sum of Rs. 6,956 be expended on experiments with wood pavement. This recommendation was confirmed in general meeting held on 31st March 1896. A length of Merchant street, 120 feet, extending from Soolay Pagoda road to 32nd Street was selected to be laid the full breadth of road-way, or 50 feet, the total area being 6,000 square feet or 666 square yards. Two kinds of wood were selected, *viz*: teak and pyinkado, one half of the area being laid with samples of each kind. The blocks used were cut to equal sizes 6 inches long, by 3 inches broad by 6 inches deep, laid on a cement concrete foundation with the fibre vertical. The blocks were not creasoted or treated in any way before being laid but were grouted with tar, sand and gravel after being laid. Expansion joints are left at the sides of the road-way, along each length of channel about two inches in width, to provide for expansion and contraction. The pavement was laid in the rains, and was completed by the end of August 1896. A kerb and channel of brick and cement had to be laid on the south side of Merchant street, there being no footpath existing to bind in the blocks. The actual cost of laying this piece of wood pavement, exclusive of the cost of forming footpath kerb and channel on the south side of the street was Rs. 5,250-11-7, or about Rs. 0-14-0 per square foot, or about Rs. 7-14-0 per square yard. The cost of the blocks delivered were, for teak Rs. 50-0-0 per ton, and for pyinkado Rs. 42-0-0 per ton. It is thought that these prices, especially for teak, might be considerably reduced, should there be an increased demand for these blocks. The number of teak blocks to a ton of 60 cubic feet is about 880; 742 of these blocks as laid in Merchant street occupy an area of about 100 square feet. To reduce the first cost of providing the foundation, which must be of a lasting and substantial nature, and not liable to subsidence, it is suggested that in laying any future pavement of this description, lime concrete might be tried. The estimated cost of the same area as already laid, if laid in lime concrete, would be about Rs. 4,125-0-0, or about Rs. 6 3-0 per square yard. To re-lay the road surface with blocks after the initial foundation has been originally put in, would cost about Rs. 4-9-0 per square yard, taking the blocks to cost the same per ton as for these already laid in Merchant street. Should the blocks be obtainable, as may be reasonably expected, for about Rs. 40 per ton for large quantities, the cost per square yard of renewing and re-laying would be about Rs. 4-2-0. The annual cost of maintenance and repair for macadam is about Re 1 per 100 square feet per annum; with wood pavement it is believed that this annual charge would be much reduced.

It is of course as yet too early to give any definite report on the results of the wood pavement now laid, in regard to duration and any other qualities it may have over macadam. It will be seen, however, that the initial cost of laying it down and renewing it, is about double that of macadam, at present prices of stone metal. It remains to be seen whether the wood will be more lasting in respect of its other qualities of being a smoother and less noisy road-way. The life of macadam laid 6 inches deep on our main thoroughfares may be taken on an average at about from 4 to 5 years, so that the wood to be equal should last about 8 years before requiring entire renewal. Time only can show how far these qualities of wood pavement may extend. Meantime another length of wood pavement might be laid, on a lime concrete bed, say in Dalhousie street west of Soolay Pagoda road where the traffic is very heavy and where the tramway lines also pass thorough. From 32nd Street west to 31st Street would cost about Rs. 4,500, or even to Tsee Kai Maung Taulav Street would cost a total sum of Rs. 9,000 exclusive of the cost of re-laying the tram line which should be laid with continuous girder rails on a permanent concrete foundation throughout; as recommended in my report on the present tramway lines, the existing construction of the tram lines is not suitable for laying wood pavement satisfactorily.—*Rangoon Gazette.*

Woods Used by Cabinet Makers.

In a recent issue of *L' Echo Forestier*, appears a descriptive list of the various rare woods used in cabinet-making. It might be of interest to give the list entire.

Amboyna wood* is one of the most precious known. It has much the appearance of the choicest elm knots, † though of greater delicacy On account of its rarity, it is seldom used for furniture, though small coffers and clock-cases are made of it.

Close upon this follows black ebony, much of which is brought from Africa, though the most beautiful varieties come from the Island of Mauritius Green ebony, of a dark olive-green color, is furnished by Madagascar Portugal ebony, ‡ from South America, is veined black and fawn color Guiac wood, ‖ of a greenish-brown, comes from America Pomegranate wood, dark green a native of Cochin China Iron wood dark brown, very dense and heavy, an American product. *Bois d amourette*, § from China, veined red and black, and much in demand Agri, or perfumed wood, of a dark brown, also from China The island service-tree, ¶ dark brown, from Africa, Asia and America Coral wood, ** of a beautiful red tint; and sandal-wood, in shades passing from dark red to pale yellow, all from India Bamboo, in different shades, from different countries Letter-wood †† of variable red, from America Partridge wood,‡‡ gray-brown, from Martinique

This list is sufficient to give an idea of the variety and richness of the darker woods used in cabinet-making In regard to the lighter colored woods, a word may be said

As mahogany§§ might be regarded as the type of the darker colored woods, maple might be taken as the type of those of a lighter color The finest maple is from America It is very difficult to work and requires skilled hands because the slightest

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[*] *Bois d amboine* from the island Amboyna of the Dutch Moluccas Reported, though with doubt as *Flindersia Amboinensis* Poir, of the natural order *Meliaceæ*, allied to the geranium family

[†] *Loupe d orme*, of elm knots, or excrescences, pretty knic knacks and toys are often made, though they never grow large enough for the purposes of cabinet makers

[‡] Portugal ebony is not a true ebony, but belongs to the natural order *Leguminosæ*, and is closely related to our native honey locust *Gleditschia triacanthos)* The true or black ebonies are of the natural order *Ebenanceæ*, and of the genus *Diospyros*, of which our native persimmon *(D Virginiana)* is a species

[‖] Guiac wood is from the tree *Guaiacum officinale*, L a relative of the wofer ash *(Ptelea)* common along our more southern streams The wood contains the resin known to medicine

[§] *Bois d amourette* a name but awkardly translatable It is from the tree *Acacia tenuifolia*, Willd, belonging to the natural order *Leguminosæ*, and also a relative of the honey locust and wild sensitive plant

[¶] Service tree, a tree nearly related to our mountain ash and choke berry, *Pyrus aucuparia*, L, belonging to the natural order *Resaceæ*

[**] Coral wood is from the tree *Adenanthera pavonina*, also of the *Mimosa* division of the natural order *Leguminosæ* Another name is pea coral Its seeds are said to be of such uniform weight that they are used in the East for estimating the weight of jewels

[††] *Bois de letters*, furnished by *Piratinera Guianensis*, Aubl, a tree of the elm-family, native in Guiana

[‡‡] *Bois de perdrix*, a species of Bocoa, of the natural order *Leguminosæ*

[§§] The author supposed his readers to be so well acquainted with it that he gave no description. *Swietena mahogani*, L, of the natural order *Meliaceæ*.

bungling makes irreparable blemishes on its fair, light surface. There is no recourse to mastic or patching, as in the case of darker woods. Like mahogany, maple occurs in many varieties.

Maple knots occur in varying depths of color. They are a very rare article, and are never employed in making anything but clock cases and fancy coffers. Silver maple knots are more frequently employed, though the wood is almost as rare.

The speckled maple is sometimes very white and dotted with fairly regular and close spots. It commands about the same price as ordinary mahogany, or about $4.00 per hundred weight (40 to 50 francs per quintal).

The gray, wavy maple (*l'erable ondule)* gives the beautiful zig-zag effect of marble, and brings about the same price as the last.

Finally, the silver maple, a wood of great whiteness and taking a high polish. It is in great demand. In spite of its uniformity in coloring, it holds its place on the market on a par with the other varieties.

This last, as well as the speckled wood, is often used in the manufacture of entire pieces of furniture, while the other varieties are only used in veneering.

Citron-wood, * which is often wrongly called the wood of the citron tree, is also known as rose-wood, of the Antilles, and has no connection with the citron tree. The name citron-wood has been given it either by reason of its color, which is a pleasing yellow, or by reason of the faint aromatic odor it exhales while being worked. It is exquisite in grain and contrasts well with violet ebony. The so-called citron-wood furniture is justly much prized, but it is more suitable for mosaics and ornamental mouldings, or rose-work.

In conclusion, there might be namod among the light colored woods the cedar, so highly esteemed by the ancients. Though it comes in many colors, the most frequent is the rose-veined. We might also mentien the white cinnamon, of Ceylon ; the variegated white gum, of Guadeloupe; the gray laurel, of Mauritius ; the West India rose-wood ; the Jamaica balsam, and the tawny cypress, of Greece.

—*The Forester.* N. W.

Rudyard Kipling on the Indian Foresters.

Of the wheels of public service that turn under the Indian Government there is none more important than the Department of Woods and Forests. The reboisement of all India is in its hands or will be when Government has the money to spare Its servants wrestle with wandering sand torrents and shifting dunes, wattling them at the sides damming them in front, and pegging them down atop with coarse grass and unhappy pine after the rules of Nancy. They are responsible for all the timber in the State forests of the Himalayas, as well as for the denuded hillsides that the monsoons wash into dry gullies and aching ravines, each cut a mouth crying aloud what carelessness can do They experiment with battalions of foreign trees and coax the blue gum to take root and perhaps dry up the canal fever In the plains the chief part of their duty is to see that the belt fire lines in the forest reserves are kept clean, so that when drought comes and the cattle starve, they may throw the reserve open to the villagers' herds and allow the man himself to gather sticks They poll and lop for the stacked railway fuel along the lines that burn no coal, they calculate the profit of their plantations to five points of decimals they are the doctors and midwives of the huge teak forests of Upper Burmah the rubber of the Eastern jungles, and they are always hampered by lack of funds But since a Forest officer s business takes him far from the beaten track and the regular stations he learns to grow wise in more than wood-lore alone, to know the people and the polity of the jungle, meeting tiger, leopard, bear wild dog, and all the deer, not once or twice after days of beating, but again and again in the execution of his duty. He spends much time in saddle or under canvas, the friend of newly planted trees the associate of uncouth rangers and hairy trackers till the woods that show his care in turn set their mark upon him, and he ceases to sing the naughty French songs he learned at Nancy, and grows silent with the silent things of the undergrowth —*Kipling in McClure's Magazine.*

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* *Bois de citron ;* the French name for *Erithalis fruticosa,* of the order *Rubiaceæ,* and not to be confused with the product known in English by the same name, *i. e., Callitris quadrivalvis,* a conifer of Africa yielding the gum resin sandarac.

A Spider that Eats Birds.

If asked to name the thing I most dreaded when in the tropical forests on the Savannas, says a writer in the *New Orleans Times-Democrat*, I think it would be the centipede Scorpions are bad enough , some species of ants are extremely troublesome; various minute insects, like the "bete rouge" or red bug, the chigoe or "jigger," and the "garrapata" or wood-tick, are things to be avoided , but the centipede is by far the worst of them all. It has not, as its name would indicate, a hundred feet, but it has between thirty and forty, each one poisonous. And once let a centipede get on your skin and become alarmed, no power on earth can remove it quickly enough to prevent it from digging its venomous claws into your flesh It moves with the celerity of "greased lightning," and when seen running across an open floor appears like a brown streak There is one other object more horrible to contemplate, and that is the tarantula, which also moves with surprising quickness It does not glide, however, like a thing of evil, as the centipede does, but leaps direct at one with a viciousness not to be mistaken I remember well my first attempt to capture one in the beautiful botanical garden of Martinique, in the West Indies I was strolling along the avenue of stately palms (since destroyed by a hurricane), when I saw a big tarantula directly in the path before me, half-hidden beneath the dead leaf of a bread-fruit tree I had a stick in my hand, and poked the spider to make it get into the open Instead of turning about to escape, it made a leap for my hand, which it missed only by a few inches That was enough for me, I did not crave a live tarantula for my collection, though a moment later there was a dead spider in the path Even in death it is an ugly appearing thing, large and hairy, with legs that would stretch across a saucer On another occasion I saw a tarantula on the wall of a hut by the roadside, right over the doorway, through which the occupants of the hut a black woman and her children were constantly passing I called their attention to the creature but they merely glanced at it carelessly, and allowed it to retreat into the thatch of the roof

There is, however, one spider larger than the common tarantula, which is abundant enough to be an object of dread in the forests of the Guianas This is the great Bird Spider, the *Mygale avicularia* which catches and kills not only birds, but lizards, other small reptiles, and even young chickens It builds its nest in the trees and there lies in wait, just as the house spider does for flies, leaping upon its victim like a tiger It is, in fact, the tiger of the tribe, and is justly feared by both birds and human beings In my excursions into the woods I used to pass an old tree, the trunk of which was slightly hollowed Beneath the overhanging bark above the hollow a family of bats had affixed themselves, six of them, hanging by their toes, noses downward. They always clung in the form of a triangle, three bats in the upper row, then a row of two, a single bat at the bottom One day I missed the lowermost one, but the next day his place had been supplied. The following day two were gone , and when I inquired of my negro guide the reason and manner of his taking off, he informed me that probably a bird spider had captured him At another time I was hunting along the shore for small birds, among the sea-grapes, the hanging racemes of creamy white flowers attracting birds and insects, owing to the honey which they contained The first bird I shot there was a black and yellow "sugar-eater," so called from its liking for sugar and all sweet things, a frequent visitor to the sugar plantations during the boiling season It fell, as I fired, into a dense cluster of sea-grapes, another bird attracted my attention just then, and first noting the location of the one I had shot, I went in pursuit of the second. I soon returned, but could not find my bird, though I knew he must be somewhere near. As I was peering through the leaves, however, a slight rustling drew my attention to a very comical sight. It was a large lizard, which, with one foot placed upon the bird I had shot, was intently watching me with his diamond-bright eyes. He had stripped off some of the feathers from the dead bird, which he was hastily devouring, having first drawn it some distance from the spot where it had fallen. A tuft of yellow feathers stuck to his nose, and these he vainly endeavoured to scratch off with the claws of his right forefoot, at the same time eyeing me very suspiciously. First he would make a dig at his nose, then cock his head over to one side with a malicious gleam in his eyes, as if to ask what I was going to do about it. The whole proceeding seems to me so entertaining that, as there were sugar-eaters in plenty, I was ready to leave Mr Lizard in possession and go off in search of another bird. But suddenly, just as I was turning away, a black, hairy object fell upon the lizard; there was a short, sharp struggle, and my predatory friend was still in death. I was much disgusted at the terminations of the adventure. I might easily have killed the spider (for such it was), but I did not; I left him to enjoy his double dinner of bird and lizard. It was indeed a revolting spectacle to see that horrible thing descend upon its victim. Its bite or sting is said to be extremely poisonous, and I concluded that this must be so from the expeditious manner in which it caused the death of the unlucky little reptile, itself as long as its slayer. The incident made me decidedly nervous. The hideous looking, but harmless iguanas have a habit of darting noisily through and over the dead leaves on the ground, and for a long time, at every rush I would leap hastily aside, under the impression that it was one of those huge and venomous spiders.

VII.-TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

3rd December, 1896.

East India Teak.—The deliveries for the eleven months of this year have totalled 20,105 loads against 17,003 loads for that period of 1895 ; and in the past November they have been 1,808 loads against 1,684 loads in November last year. The market continues brilliant, and a further advance in the price of floating cargoes has to be recorded in November.

Rosewood, East India—is enquired for, and small parcels of large good logs would sell well.

Satinwood, East India—The principal demand is for figury logs, which are scarce.

Ebony.—East India—Small parcels of good logs would bring high rates.

PRICE CURRENT.

Indian teak	per load	£11	to	£16
Rosewood	„ ton	£6	to	£10
Satinwood	„ sup foot.	8d.	to	12d.
Ebony	„ ton	£6	to	£8

MARKET RATES OF PRODUCTS.

Tropical Agriculturist, December, 1896.

Cardamoms		per lb.	2s. 6d.	to	3s.
Croton seeds		per cwt.	77s. 6d.	to	80s.
Cutch		„	9s. 3d.	to	32s. 6d.
Gum Arabic, Madras		„	37s. 6d.	to	45s.
Gum Kino		„	£45	to	£55.
Indiarubber,	Assam	per lb.	1s. 10d.	to	2s. 3½d.
„	Burma	„	1s 4d.	to	1s. 11½d
Myrabolams,	Madras	per cwt.	3s. 9d.	to	5s. 6d.
„	Bombay	„	4s. 3d.	to	7s. 6d.
„	Jubbulpore	„	4s.	to	6s. 6d.
„	Calcutta	„	4s.	to	6s.
Nux Vomica, Madras		„	6s.	to	7s. 6d.
Oil, Lemon Grass		per lb.	2½d.		
Orchella, Ceylon		per ton	11s.	to	15s.
Sandalwood, logs		„	£30	to	£50
„ chips		„	£4	to	£8
Sapanwood,		„	£4	to	£5
Seed lac		„	70s.	to	80s.
Tamarinds		„	9s.		

Statement of average selling rates of timber and bamboos in Moradabad, Pilibhit, and Delhi for the month of November 1896

Description.	Timber scantlings per score		Bamboos per 100 score		REMARKS
	From	To	From	To	
	R A P	R A P	R A P	R A P	
MORADABAD					
Sál, 10' Tors (Poles)	20 0 0	25 0 0			
Sál and Sain, &c, Karis 12 × 5" × 4" Sal	50 0 0	60 0 0			
Sain	30 0 0	40 0 0			
Sál bed posts, 7 × 2½" × 2½	0 8 0	0 10 0			
Bamboos of 9 to 10 per 100 score			50 0 0	75 0 0	
PILIBHIT.					
Sál, 10' Tors (Poles)	33 0 0	60 0 0			
Sál and Sain, &c, Karis 12' × 5 × 4"	25 0 0	35 0 0			
Sál bed posts, 7 × 2½" × 2½ ...	4 0 0	5 0 0			
Bamboos of 9 to 10' per 100 score			33 0 0	80 0 0 400 0 0	
DELHI.					
Sál, 10 Tors (Poles)	5 0 0	7 0 0			
Sál and Sain, &c, Karis, 12 × 5 × 4" Sal	30 0 0	58 0 0			
Sain	18 0 0	25 0 0			
Sál bed posts 7 × 2½" × 2½	8 0 0	9 0 0			
Bamboos of 9 to 10 per 100 score			20 0 0	75 0 0	

THE
INDIAN FORESTER.

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The "Restoration" of Mountains.

The *Revue des Eaux et Forêts* has an article from the pen of M Charles Broilliard on the subject of the fixation and consolidation of the French Alps to put an end to the disastrous inundations and torrents which devastate the low-lying country. One is inclined to think of "restoration" of mountains as synonymous with "reboisment," but, although reboisment is the aim, there is yet a long stage to be passed through before we can arrive at this and in many places it is necessary to be content with a mere clothing of the hillsides with grass In France they passed a law in 1860 under which the Forest Department was given very large powers for dealing with this matter, but the law of 1882 cut these powers down very considerably. The Department is now obliged to pay for all ground it takes up as "perimeters of reboisment," or, if it does not actually buy out proprietary rights, but merely takes over the land to deal with, it can only take it over for ten years and must pay a rent for it However, M Broilliard finds a means of effecting the purpose aimed at—at any rate to a considerable extent—in article 5 of the existing law, which allows the grant of "subventions" to persons taking upon themselves works of improvement of the kind required. M. Broilliard shews that there is practically no hope of effectually dealing with the Alps by direct artificial reboisment, considering the enormous area concerned, but he thinks that with the help of this article 5 of the law, the aim may be attained nevertheless. His suggestion simply is that the State should pay communes and owners of mountain waste lands (and it would seem that the country in question is practically entirely the property of communes and private proprietors) a subvention in return for substituting cattle-grazing for sheep and goat-grazing on the areas in question. The fact is that in addition to the actual grazing of cattle being less obnoxious than that of sheep and goats, it also cannot extend to the steeper slopes, which are the prime cause of the mischief, and whence especially torrents and inundations have their source, and this will allow of grass and eventually trees establishing themselves Up to date the State has only been able to take in hand some five per cent of the total area affected, and at this rate the work would seem to be hopeless Moreover, the hopelessness is not merely one of length of time, but of means also, the figure to be paid would be one that imagination "boggles" at It is therefore absolutely necessary to find some means of a general and far-reaching kind (like fire conservancy in India), which will allow nature herself to act, and this measure, as stated above, is to be found in the substitution of the cow for the goat and sheep. But M Broilliard contends, not only that this is possible under the existing law, but also that it will be most advantageous to the owners themselves Though this gain may not be seen by them at once, it will very soon be made clear to them after an object-lesson or two, and when the measure has been extended to a few communes all should gradually come to see things in their true light The gain consists in the fact that the introduction of fruitières"—cheese manufactories in the mountains where the cattle are housed on the premises, and graze on the Alpine herbage—has very greatly enriched the promoters and local inhabitants engaged in the business, and M Broilliard quotes statistics to show how great this improvement has been in the countries where ' fruitières have taken root Moreover the number of sheep and goats has already very much diminished in these parts under the indirect influence of "fruitières"

On the general question of the stability of mountains, it seems to me that people are apt to forget that when the hill is itself shattered through geological causes, as is the case with a great part of the Himalayas, no tree-growth can really prevent slipping, the origin of the evil being far below the roots, although it will, no doubt, prevent the water rushing off in torrential form and launching itself with accumulated force on the country below But while there is this advantage, there is yet another risk due to this very prevention of rapid running off of water namely that the water has time to sink in, and the weight on the hillside then becomes enormous. It was said to be due to saturation of this kind that the great slip of 1880 occurred at Naini Tal This danger would affect the valley immediately below, while the fields at the base of the mountain range would, of course, always benefit by a retarded flow of water from above

Then, too, it is necessary to find the best form of forest to grow on a hillside A great deal might be written on this subject, but as a first suggestion, I would point out that trees of large growth are apt to be swayed by the wind, and therefore to loosen the soil at their roots, and it would consequently seem advisable to adopt as thick a growth of simple coppice as possible

MILES.

For little-known Trees—a Correction.

The article on little-known trees in our December number contains an error, the timber therein referred to as *Eriolæna Candollei* being the wood of *Cordia Macleodii* The particular log on which our remarks were based is one which was sent to Mr Gleadow, some time ago, as *E. Candollei*, and he, after trying it for various uses, only thought of comparing it with the Forest School specimens after sending us the information, the log he used having come from a source usually quite reliable.

Eriolæna Candollei is itself a good timber which might well have found a place in our article, but, its appropriate uses differ from those of *Cordia Macleodii* The former is a tough wood of a brick-red colour possessing considerable elasticity and strength ; the annual rings are distinct It is an excellent timber for shafts and such purposes *Cordia Macleodii*, on the other hand, is a wood of no great strength, but easy to work, of sufficient hardness, and of some beauty.

II—CORRESPONDENCE.

India Rubber.

With reference to the extract from the *Spectator*, which appears in the *Indian Forester* of December 1896, I would ask whether any experiments have been made to determine the nature of the sticky milky juice of some of the *Apocyneæ* (*e g*, *Wrightia*), *Euphorbiaceæ* (*e g* *Euphorbia antiquorum* and *Cattimandoo*), and *Asclepiadeæ* (*e g* *Calotropis gigantea*)

When the juice is pressed between the fingers they all produce an indiarubbery substance and look as if they contained a certain proportion of indiarubber. Although that proportion may be very small, nevertheless, if it exists, it should, from the copiousness of the juice in the trees and the large number of trees which are found together in some parts, be a workable produce ; especially considering the demand that is pronounced by the article under reference to exist at the present time

I made an attempt to extract rubber from *Euphorbia antiquorum* by means of spirit, as explained in an early number of the *Indian Forester*, but no rubber separated itself in shreds, as therein explained , merely a precipitate and skin formed The precipitate, when washed, was plastic but more like putty than rubber, and consolidated into a hardish mass when dry. The residue juice still remained sticky.

A. W. Lushington.

Kistna,
8th January 1897.

Bassia Latifolia.

With reference to Mr Bagshawe's letter in your December's issue, regarding the early appearance of Mahua flowers, I beg to inform you that the season in the Kistna District also appears to be irregular Whilst there were heavy floods in the District due to freshes in the Kistna from excessive rain in the Bombay hills the rainfall in this District was far below the average It may be noted that the Forest rain-gauges at Kondapalli and Bellamkonda showed a fall at the end of November of 16 and 14 inches only, as compared with 41 and 35 inches at the corresponding period of the year before

In October the Mango and Gyrocarpus were found in flower at Kondapalli (pointed out shortly after to the Conservator then on tour in the District), and at Nekarikal in early December the nim was found both in flower and young fruit and producing a fresh flush of leaves

A. W. LUSHINGTON.

KISTNA, *8th January 1897.*

Working Plans in the Southern Circle of Bombay.

Mr C M Hodgson's corrections of my para 7, which appeared in your October number, require a few words in the shape of explanation What Mr Hodgson calls "teak predominating" I call 'pure teak forest" By this it is not meant that no other vegetation, except teak, is found in the forest Mr Hodgson evidently had not seen the printed working plans report for Central Kolaba, or he would not have still held the same views he held formerly I measured the diameters of 446 mature exploitable teak trees at breast height in Panvel, 4,719 trees in Pen and 5 626 trees in Nagotna and their average diameters are 8 9, 9 1 and 8 7 inches respectively, the average diameter of 16,251 trees in Central Kolaba is 8 7 inches only Mr Hodgson measured 71 mature exploitable trees in Panvel, 309 in Pen and 160 in Nagotna, and their average diameters are 11 9, 11 5 and 11 8 inches respectively, the average diameter of 540 trees (not 550) measured by him is 11 8 inches The maximum age counted by him in a 15-inch tree is 195 years, maximum diameter measured by him is 21 inches (the age of this tree was 54 years) The minimum age counted by him was 20 years, and the diameters found were 7 3 and 11 2 inches, Mr E G Oliver in his Southern Kolaba Working Plans Report para 60, writes as follows —

"There is a lot of further information in Appendix I, compar'ing the results of the Central Kolaba plan with this one. It calls

'for no remarks from me, except that it would appear from Mr.
'Hodgson's data that he selected rather large felled trees for his
'measurements, because his average diameter (of felled trees) is
'11 8 inches for Central Kolaba, whereas the average diameter of
'standing trees for the same district is only 9 1 inches In any
'case, from his own figures he could not possibly have had more
'than 40 years' rotation "

It would be more to the point if Mr Hodgson were to establish the rotation he recommends from his measured trees, instead of arriving at a conclusion on mere assumption

For the reasons stated in the report clean-cutting was recommended Government has been pleased to decide that standards of teak not exceeding 30 to an acre, when available, are to be reserved There are 34 teak trees per acre, on an average, in the Central Kolaba forests

BOMBAY

ORGANIZATION.

The Use of so-called Inferior Woods.

I think sometime ago the Government of India, in reviewing one of the Annual Forest Reports of Upper Burma, hoped that Forest officers would endeavour to introduce the use of many of the other excellent woods known to be in the forests instead of teak, in the building of Pongyi-Kyaungs and Zayats How this was to be done was not stated However, since then the only help the Forest Department has received in this direction has been the introduction of a clause in the Upper Burma Forest Rules, forbidding any Forest officer from refusing a free grant of teak without the sanction of the Deputy Commissioner, which must be in writing It will hardly seem strange, therefore, that the use of ' other woods ' has not advanced by leaps and bounds

Now, would it not be better if a small royalty was charged on all teak timber used in such works *viz*, Rs 3 a ton An ordinary Zayat uses about 20 tons of teak , now surely Rs 60 is not much to ask a Burman to pay for the sake of eternal happiness, not to mention the title of Zayat-taga

TAWKWE.

P S—For the benefit of your Indian readers I should mention that "Pôngyi-Kyaung" is a monastery, ' Zayat," a traveller's Rest-House and " Zayat-taga," an honorary title popularly given to builders of Zayats.

Forest Administration Policy.

Allow me to send you for publication in the *Indian Forester* an extract from a letter written by General J Michael to the '*Standard*' on Chapter XXXI of Lord Roberts' book, published in the *Pioneer* of the 7th February 1897 General Michael, as you will see, criticises the Forest policy adopted by the Government of India on data gathered and experience gained when the late Dr. Cleghorn was forming the embryo Forest Department in the Madras Presidency

What was done then, or what was the policy adopted in those days it is difficult for us to say, but it seems hard to read criticisms of the kind made by General Michael and published in a leading English paper after the Circulars that have lately issued from the Government of India on the subject of Forest policy As we all know, the policy therein enunciated was one for the people, and the reduction in the annual surplus to the State coffers of the Central Provinces has been partly caused by that policy being carried out.

It may be said that the mere fact of the enunciation of the Forest policy by the Indian Government shews that some trenching on the rights of the masses had come to notice, be that as it may, criticisms of the wholesale nature made by General Michael should not, I think, be written without acknowledging the existing policy, and should not condemn a progressive Government for what took place in the past

Has General Michael ever read the Indian Forest Act of 1878 as amended by Act V of 1890? If he had he would have seen that both the Chapters relating to Reserved State Forests and Protected Forest provide for the full enjoyment of existing rights of village communities and individuals People in England reading the General's letter would not imagine that to be the case, and would at once jump to the conclusion that the Forest areas have been made without any consideration of the existing right of adverse possession etc , and even might think that villages had been razed to the ground and the inhabitants removed without any compunction by ruthless Forest Settlement officers Regarding the fact "that conservancy under stringent legislative Acts has notoriously become obnoxious to the masses' I beg to draw attention to the number of Native States who have applied to the Indian Government for the services of trained Forest Officers to help in the preservation of their forests—which preservation is usually done on the lines of the Indian Forest Act, which surely points to the fact that the conservation of forest land is not so obnoxious as stated

L.

Extract from Pioneer

“ General J Michael, in a letter to the *Standard*, says —In
‘ your first notice of Lord Roberts ’ book you give prominence to
‘ Chapter XXXI, which you state ‘ forms probably the most important
‘ State paper written upon the Government of India in our
‘ time—the solemn warning against the danger of over-centralisation
‘ and unsympathetic legislation in accordance with Western
‘ ideas comes with the authority of a knowledge of India hardly
‘ rivalled and of an impartiality not to be expected from any one
‘ who has held a responsible place in the Civil administration ”

‘ You quote Lord Roberts as follows —

‘ For a considerable time after the Mutiny we became more
‘ cautious and conciliatory in administrative and legislative matters,
‘ more intent on doing what would keep the chiefs and rulers satisfied
the masses contented and the country quiet, than on carrying
‘ out our own ideas Gradually this wholesome caution is being
disregarded The Government has become more and more centralised
‘ and the departmental spirit very strong Each department
‘ in its laudable wish for progress and advancement is apt to push
‘ on measures which are obnoxious to the natives either from their
‘ not being properly understood or from their being opposed to
‘ their traditions and habits of life thus entailing the sacrifice of
‘ many cherished customs and privileges Each department admits
‘ in theory the necessity for caution but in practice presses for
‘ liberty of action to further its own particular schemes Of late
‘ years too the tendency has been to increase the number of departments
‘ and of secretariat offices under the Supreme Government,
‘ and this tendency while causing more work to devolve on the
Supreme Government than it can efficiently perform results in
‘ lessening the responsibility of provincial Governments by interference
in the management of local concerns ”

‘ Amongst the causes which have produced discontent of late
‘ years I would mention our Forest Laws and sanitary regulations,
‘ our legislative and fiscal systems—measures so necessary that no
‘ one interested in the prosperity of India could cavil at their
‘ introduction but which are so absolutely foreign to native ideas
‘ that it is essential they should be applied with the utmost gentleness
‘ and circumspection ”

‘ As one who played a part in the inception of Indian forest
‘ conservancy I would venture if it be not a presumption, to endorse
‘ what Lord Roberts says regarding Forest laws On that point
‘ I speak *ex cathedra* ’

“ Conservancy under stringent legislative Acts has notoriously
‘ become obnoxious to the masses who consider some of the provisions
‘ of the law an outrage on their ancient village customs and
‘ privileges But it was not always so When conservancy was
‘ first attempted in Southern India, so far back as 1848, the Madras

'Government wisely laid down the principle that the preservation of forests and their equitable working should be the first consideration, and the acquisition of revenue a secondary one. In starting the operations, therefore, all existing communal or other rights and privileges of villagers were carefully considered, and were maintained to the best of our ability Even where leases of forest land had been acquired, they were purchased back by the Government at liberal prices Thus, when the experiment had been working for six or seven years and had proved a success and when the Government and the Court of Directors deemed it right that the conservancy should be extended to other parts of the presidency, no difficulty was experienced in doing so, because there was little or no opposition, or ill-feeling, on the part of the people The small Forest Department which was then formed under the late Dr. Cleghorn moved on the same conciliatory lines, and he was able to carry the work on smoothly for many years Soon however, came a more general extension of conservancy An Imperial Forest Department was formed by the Government of India, with a German expert (the eminent Sir Dietrich Brandis) at its head and with rapid strides forestry on scientific lines spread throughout India and British Burma carrying with it vast financial successes Then, also, soon followed centralisation and the forest legislative Acts, which are so hard to work without trenching on what the masses have always looked upon as unalienable rights and privileges exercised and enjoyed by the villagers from time immemorial"

' No one as Lord Roberts says can doubt that such legislation and innovations are destined, in the long run, to confer incalculable benefit on the country at large, but in the application of some of the provisions of these Acts we have gone too fast for the understanding of the people"

"Long after I had become separated from the early forest operations, my friend Dr Cleghorn used to pay me the compliment of consulting me upon contemplated changes and measures Among them he referred to me various drafts of proposed Forest Regulations, and I am glad to remember that I sounded to him the note of caution which Lord Roberts now impresses on us in such telling words."

"Ever since, whenever I have had the opportunity, in writing or speaking on Indian forest matters, I have sounded the same note Perhaps I may quote a few words from a paper written for the *Asiatic Quarterly Review* 10 years ago, regarding the life and duties of the young forester about to leave Coopers Hill College —' He will find many important questions affecting the communal rights and interests of the inhabitants committed to his careful consideration, and he will have to study the Indian Forest Acts, which require judicious handling, or they become oppressive."

IV.—REVIEWS

Les Landes et les Dunes de Gascogne.*

One day in August 1893, leaving the pretty villas of Arcachon with their surrounding luxuriant vegetation of pines, evergreen oaks, exotic conifers, palms and a profusion of flowering climbers, I rode with Monsieur Grandjean, the writer of this valuable little book for 30 miles through the woods of Maritime or Cluster Pine, which surmount a dense undergrowth of oaks, arbutus tree-heather and gorse, on the sandy soil of the *Forêt de la Teste* We saw the resin-tappers at their work, the young pines which had sprung up from natural seed blown from neighbouring trees on to the areas where the 60-years old pines had been tapped to death and removed, the long bare lines of the fire-traces (so necessary to isolate burning blocks of the inflammable pine forest and to assist in extinguishing a fire), the wind-swept, crooked and distorted pines on the protection-belt near the sea, where thirty-years old trees are frequently only 4 feet high, and finally, the littoral dune, stretching like a railway embankment as far as the eye can reach North or South along the Bay of Biscay

The motto of the town of Arcachon, founded as a bathing place in 1828 and now visited annually by 200,000 people, is, *Heri solitudo hodie vicus cras civitas* in truth the region of the Landes swampy in winter, an arid desert in summer, dangerously malarious where 2½ acres barely supported a sheep, and the lonely shepherds on their stilts were almost the only inhabitants, where villages and towns and Bordeaux itself, the third city of France, were threatened by the steady invasion of the sand—this desolate region has now been drained and its salubrity restored ; since 1857 1,625 000 acres have been planted with pines, roads constructed houses built fields of wheat maize, rye, and meadows interspersed among the woods whilst the population of some of the parishes have sextupled during the present century

A hundred years ago, land was so cheap in the sandy tracts of Gascony that a purchaser might climb a sand-hill and obtain for £1 a tract as far as he could make his voice heard—now, the yield of resin and turpentine from the extensive Gascon pine forests is only second to that of the United States (where resining trees is practised in a most wasteful manner and cannot be expected to last many years more), and thousands of tons of pit timber leave Bordeaux annually for the Welsh coal mines

Grandjean gives an interesting account of the geology of the region, with its rows of sandy hills parallel to the coast, which up to the end of last century were continually invading the more fertile country to the East, the impermeable strata termed *altos*, which helped to form the swamps, the lagoons which appear to be land-locked inlets cut off from the sea by sand-bars, the water having lost its saltness by filtering through the sand Gascony at the end of last century was an immense desert of shifting sand, the drainage water was driven back landwards, forests and villages were buried, or about to be buried in sand

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* By C Grandjean Inspecteur adjoint des Forêts , with 10 plates, pp 92. Paris J Rothschild, 13 Rue des Saints Péres

A separate chapter is devoted to the history of the fixing of these shifting sand-dunes, and from this it appears that, (omitting a reference to the former unsuccessful attempts to solve the problem) in 1769, and again in 1776, the Abbé Désbiez and his brother read papers to the Academy of Bordeaux on proposed methods of arresting these destructive sands It appears that, in 1779, some attempts were made by de Ruat and Désbiez to protect their own estates by planting trees, but these plantations were destroyed by sheep The trees said to have been used by Désbiez were planes and poplars, which will thrive only where there is sufficient permanent moisture in the soil, certainly not in the arid sand where only pines can grow

In 1776, Louis XVI, by the advice of Neckar, sent the Baron of Charlevoix-Villers, a naval engineer from St Domingo, to report on the establishment of a naval port at Arcachon and the latter, after thoroughly examining the region, submitted several reports, in which he mentions the names of all who had made previous suggestions towards fixing the sand and recommended that the first step to be taken should be to sow pines, the very means which were afterwards successfully adopted De Villers met with much hostility from high local officials who were jealous of his influence at Court, and, suffering badly from malarial fever he was unable to carry out his well devised plans ; he therefore returned to St. Domingo in 1784

Brémontier an assistant State engineer at Bordeaux, was then taken up by the local authorities, who handed him the reports and papers of de Villers and Désbiez ; of these he made full use, but entirely ignored them in his own writings Being however, a clever, active man and thoroughly believing in the future success of his plans he obtained, in 1788, an annual credit of £180, and commenced operations near Arcachon, sowing up and fixing 900 acres of sandy dune by 1793. His work was, however, interrupted by the revolutionary troubles till 1800, when the First Consul allotted £2 000 a year for it and this amount was gradually increased up to £16 000 in 1854

Statues have been raised to Brémontier and streets named after Desbiez, both in Bordeaux and Arcachon, but no notice was taken of de Villers, the originator of the successful scheme for fixing the sand, till 1890 when M Dulignon-Desgranges read a paper before the Academy of Bordeaux, which justly assigned the share each of these three men had taken in the enterprise. Up to the present time, at the expense of the State, 157,800 acres of sand-dunes have been fixed and planted with pines, 54,800 acres of *ledes* (low lands between the dunes) have been drained and handed, over to the villages for cultivation or pasture, 7,500 acres bordering on the ocean are kept as protective forest, while future invasions of sand are guarded against by over 125 miles of littoral dune, which is carefully maintained in good condition.

Grandjean considers that the chief danger which now threatens Arcachon is from the reduction of the area of its basin, owing to the cultivation of oysters, which at present occupies an area of 10,000 acres, and supports 20,000 people, producing annually 300,000,000 oysters. The consequent reduction in depth of the basin is driving the sea against Arcachon, and very costly works are neccessary to protect the town and its beach effectually.

A chapter on the littoral dune explains in full detail its mode of construction and maintenance, and Grandjean modestly relates how he has been able to reduce the cost of the latter by means of marram grass (*Psamma arenaria*), as by planting it thickly, sand may be made to accumulate in depressions, while by cutting away any excess of marram from the surface of the dune, all superfluous sand is removed by the wind.

France may be justly proud of this conquest over the wild forces of nature, the works to secure which are now visited by many foreign engineers and foresters. M. Grandjean promises to publish shortly a further work on the legislation of the dunes and the management of the maritime pine forests and the works for draining and improving the Landes.

CLAREMONT, EGHAM,
November 9th, 1896. W. R. FISHER.

The Durabilty of Railway Sleepers.

We are indebted to the Inspector-General of Forests for a copy of the statement showing to the end of the year 1895, renewals of wooden sleepers on State railways as ascertained from experimental sleepers registered in accordance with the Government of India Circular No. 12 Railway, dated the 3rd November 1880.

Turning first to the completed experiments we find the following results recorded :—

Railway.	Description of Timber.	No. of Sleepers experimented with.	Average age at time of renewal. Years.
Rajputana Malwa	Creosoted Pine ...	217	5
	Sal ..	83	17
	Kahoo (*Terminalia Arjuna*)	13	4
Eastern Bengal N. Section	Creosoted Pine ...	1,755	8
	Sal ...	52	11
	Red Gum ...	9	9

The following table shows the state, at the end of 1895, of the principal experiments, commenced prior to 1887

Year laid down	Railway	Description of Timber	No of Sleepers laid down	Average age of unsound sleepers removed years	Sound sleepers remaining	
					No	Percentage of total laid down
1876	Rajputana—Malwa	Deodar	2054	18	19 3	98
		Creosoted Pine	6 85	11	1392	2
		Teak	689	14	193	27
		Terminalia Arjuna	1986	15	262	13
		Hardwickia binata	902	14	225	24
1877	Eastern Bengal	Sal	19 0	13	00	35
	North Western	Deodar	141	16	1152	81
1878	North Western	Creosoted Pine	38	14	185	48
1879	Eastern Bengal	Sal	200	10	14 9	71
1880	Rajputana Malwa	Creosoted Pine	13 24	9	50	0 4
	S Mahratta	Creosoted Pine	8	10	4	61
		Teak	139	9	129	93
1881	S Mahratta	Creosoted Pine	5	9	22	5
		Teak	10 0	7	991	91
1882	Rajputana Malwa	Deodar	1166	9	381	33
		Creosoted Pine	89		89	100
	North Western	Deodar	600		600	100
1883	S Mahratta	Teak	96		96	100
		Creosoted Pine	04	5	5 41	88
	North Western	Deodar	00	11	53	26
	Eastern Bengal	Sal	8 9	7	480	8
		Pyinkado	106	12	9	74
1884	Rajputana Malwa	Deodar	1194	9	1104	97
	S Mahratta	Creosoted Pine	114	6	93	81
	Eastern Bengal	Sal	6 8		6 0	95
		Pyinkado	18	7	16 8	91
	Rajpura Bhatinda	Deodar	00	11	8	9
1885	Eastern Bengal	Sal	11	8	10 9	88
		Pyinkado	1 4	8	1720	98
	North Western	Deodar	1 00	1	9 4	96
1886	S Mahratta	Pyinkado	2000	9	1981	99
	Eastern Bengal	Sal	553	7	23	94
		Pyinkado	8 1		8 1	100
	Rohilkund Kumaon	Sal	148		14 6	99
		Terminalia tomentosa	496	7	28	57

Some of the figures appear rather suspicious It will be noticed, for instance, that 90 per cent of the deodar sleepers laid down on the Rajputana-Malwa Railway in 1876 are still sound, whereas of those laid down in 1882 only 33 per cent have survived, the presumption is that in the latter case a number of pine sleepers were passed off as deodar The same has been known to happen in regard to pyinkado, sleepers of inferior hard woods dyed with cutch, being substituted for the real article.

From the older experiments it seems clear that in Northern India, deodar easily takes the first place in regard to durability, that teak comes next to it, and that both teak and sal last longer than creosoted pine It would not, however, be safe to draw general conclusions from the statistics given in the table, as apart from the amount of traffic that passes over them, sleepers of the same kind of wood vary greatly in durability according to the climate of the tract in which are used.

It is a pity that no figures are given for the Burma State Railway, where pyinkado has been principally used since the line was first opened but we believe it has been found that the latter wood is very much more lasting as a sleeper than teak.

Forest Administration in Ceylon in 1895

During the year 1895 13¼ square miles were added to the area of reserved forests which at the close of the year amounted to 84¾ square miles. 309 miles were under settlement and besides this there were 2,991 square miles of Crown forests making a total of 3,383¾ square miles.

The extent of forests surveyed up to the end of the year aggregated 106 square miles of which less than half a square mile represented the forest work done by the Survey Department during the year. The Conservator complains of the want of topographical maps and remarks on the difficulty of framing working-plans with the help of maps which only show natural features at the places where the traverses happened to cross them.

Little progress has consequently been made in regard to working-plans and it is said that the only plan in force requires revision, as under the system of treatment laid down the net revenue is entirely swallowed up by expenditure on plantations, which are constantly being ravaged by elephants and deer.

The rules for the control of *chenas* (which, we understand, are temporary forest clearings) are reported not to work satisfactorily and the Conservator recommends that they should be made more stringent.

Even in the damp climate of Ceylon the forests suffer much from fires and a great deal of damage was caused in the Eastern Province by fires which ran through a large tract of forest, destroying and injuring a number of teak and mahogany plantations. As regards the effect of fires on grazing grounds, the Conservator notes that recurrent fires kill out all the better classes of fodder grasses leaving only those kinds which are so coarse that they can only be eaten when young and that in consequence fires are continually being relighted in order to obtain a supply of young grass. On the other hand a few years' protection is said to improve the quality of the pasture.

Including offences compounded, 1,507 forest cases, involving 2,919 persons were disposed of during the year, 912 cases being convicted and 595 acquitted. The proportion of convictions was, therefore, only 60·5 per cent., which is said to be in a great measure due to the difficulty in procuring convictions caused by the non-publication of the Forest Rules and Regulations, The Conservator has recorded some interesting observations in regard to the periodicity of seeding of different kinds of trees. *Vatica obscura Chloroxylon Swietenia* and *Berrya Ammonilla* seed abundantly every year, but trees of the *Dipterocarp* family, with the exception of the species first mentioned, appear to produce good crops only at intervals varying from 2 to 7 years

Only 43 acres were added to the previously existing 1,712 acres of plantations, operations having been restricted in order that more time and money might be devoted to improvement fellings The latter have now been fairly started, and the natural reproduction consequent thereon is said to be very encouraging

The cubic contents of the timber removed from the forest is not given in the report, but the value of the material sold is stated as follows .—

	Rs
Timber ...	273 866
Firewood and charcoal ..	128 455
Other Produce	7,205
Total Rs. ...	409,526

Calamander (*Diospyros quæsita*), Satinwood (*chloroxylon Swietenia*) and Ebony are the most valuable timbers produced, flowered satinwood fetching as much as Rs 7 a cubic foot

We observe that in 1893 the Government of India ordered from Ceylon 9 224 cubic feet of Halmilla (*Berrya Ammonilla*) wood, of which, up to the end of 1895, only a little more than half had been supplied We should have thought that the Government of India could have obtained its requirements more readily from Burma, where the species is fairly abundant

The financial results of the year were as follows —

Revenue	417,375
Expenture	426 799
Total Rs .	9,424

The deficit in 1894 was Rs 72,032, and the average deficit during the previous five years Rs 34 303, so the finances appear to be improving The Conservator points out that much benefit is derived from the Department which cannot be set down in figures. "The prevention of theft of timber and the control of *chenas* alone 'have saved large quantities of valuable produce, which were 'formerly lost to Government, and as regards the control of land 'sales, Government receives gratis the services of disinterested 'officers, through whose actions the value of land has been greatly 'enhanced as the land sales for the last few years will show The 'whole of the clerical work regarding reports on land sales falls on 'the Forest establishment, which is entirely paid from Forest funds, 'while none of the revenue derived from land sales is credited to 'the Department,"

VI–EXTRACTS, NOTES & QUERIES.

Wanted Vols. I and XI of the "Indian Forester" for Coopers Hill.

Vols I and XI of the *Indian Forester* are required to complete the set in the Library at Coopers Hill Engineering College. It is hoped that any one willing to present, or sell their volumes, will communicate with W. R. Fisher, Claremont, Egham, Surrey.

The Reorganization of the Subordinate Forest Service.

A despatch from the Secretary of State announces that the scheme for reorganising the subordinate service in the Indian Forest Department has been sanctioned We have frequently pointed out the urgent need for this scheme, which will cost about 1¾ lakhs annually, but will result in a permanent gain to the State It will take three years to work out the changes, which involve a reduction in the number of subordinates temporarily employed.—*Pioneer*

Chicago Exhibition Awards.

We have received from the Inspector-General of Forests the following list of medals and diplomas awarded to the Forest Department of India in connection with the Chicago Exhibition of 1893.

Details of items for which diplomas were awarded : –

(1) "For illustrating by means of well-drawn maps the distribution of forest areas in different districts of British India and showing also the means of protection against forest fire"

(2) "For an instructive exhibit of the woods of Assam, of great value in international commerce."

(3) "For showing in a highly instructive manner the different stages of development from the crude to the manufactured article in resins and oils."

(4) "For a display of sawed Padouk lumber, the product of the Andaman Islands, well adapted for purposes of ornamental construction."

With one medal marked "Revenue and Agricultural Department."

(5) "For interesting presentation, in series, of the commercial and indigenous fibres of India, with their common and scientific names"

(6) "For excellence of a comprehensive collection of seeds from which oil is produced"

(7) "For the educational value of a collection of oils from plants growing in India, thus showing the resources of the country in oleaginous plants"

With a medal marked "Conservator of Forests"

(8) "For a good collection of the minor forest products of the North-Western Provinces of India"

(9) "For an exhibit of the valuable timber of the Central Provinces of India among which teak-wood and satinwood may be mentioned as most important for international commerce"

With one medal marked "Conservator of Forests"

In adition to the above awards the Forest Departments in Madras and Bombay have each received a medal and diploma while a medal and diploma have been awarded to Mistri Harnam Singh, of Chandeli in the Hoshiarpur District Punjab, for the carved mantelpiece described on page 13 of the Chicago Exhibition Handbook, and to Maung Shwe Daing of Mandalay for the carved doorway of teakwood specified on page 32 of the Handbook Two medals have also been awarded to the Inspector-General of Forests in connection with diplomas (5) and (6)

The 9 diplomas and 3 medals have been sent to the Dehra Dun Forest School, where they will be suitably mounted and deposited in the Museum

The Scarcity of Teak.

Mr. Keith Anstruther writes to the *Globe* —Referring to your recent article on the "Scarcity of Teak," I would say that there is no reckless exhaustion of the forests allowed by the Government of Siam, and we all know that our own Government, is conserving most strictly the teak interests in Burma Present trade information denotes only a slight improvement upon recent prices, and the quotations themselves show that the trade cannot afford to pay prices that would justify greater deliveries Unless the demand were equal to the supply, prices would revert to their old figures The Siamese Government is by no means indifferent in the matter of conserving their forests and replenishing them, and it has at the present moment one of the most able of our own Forest officers advising on all matters connected with the Forest Department. It is shown by the present forest leases, that the

Siamese Government is fully aware of the value of their property in the north, and are doing their utmost to conserve it Having up to the present time represented in the Northern States of Siam the only purely Forest company in the Lao States I say distinctly that the Siamese Government is now controlling the work in the forests, so that there is no fear of de-forestation, and the only question is whether the trade can afford to pay the prices that will be remunerative to foresters, for the expenses connected with the business are so great that the returns at the present time can scarcely afford margin of profit

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Gutta Percha.

The Foreign Office has recently issued a Report by Consul Churchill on the Balata industry of the colony of Netherlands Guiana which is of interest to Forest officers in India as it shows that the list of trees which yield gutta-percha or indiarubber is by no means complete

Balata is a kind of gutta percha obtained from the milky juice of the bark of the bully or bullet tree *Mimusops Balata*, a large forest tree belonging to the order *Sapotaceæ* which ranges from Jamaica and Trinidad to Venezuela and French Guiana Although the tree has been known for years past and its wood, which is very hard largely used for sugar-mill rollers machinery and building purposes the collection of the juice for the manufacture of gutta-percha is of quite recent origin and it is to this point that we wish to draw attention as there are probably a number of trees indigenous to India which are capable of yielding gutta-percha in paying quantities The matter is worth the attention of Forest officers especially of them in charge of evergreen forests in the Southern Provinces In connection with this we would invite a reference to a letter from Mr Lushington printed in this month's issue, and to the genera mentioned by him would add ***Isonandra***, which also belongs to the order *Sapolaceæ*

We reproduce below some extracts from the report in question —

'The bullet-tree is found (in Netherlands Guiana) in greater abundance in the low-lying zone of fluvio-marine deposit. It is also found in the higher lands of the interior but in a less abundant and more scattered condition On the bullet-tree bearing grounds in forests where they are plentiful, the observer may see from 20 to 30 trees of a thickness of 12 to 30 inches within a radius of 100 feet around him, where this tree is less plentiful, the observer will only see two or three trees within the same area. The bleeder usually looks over his head and discovers the tree by its foliage He also knows that the bullet-tree must be near when he comes upon certain kinds of bush. Above a trunk thickness of about 30 inches the tree is usually not worth bleeding'

'The tree often grows in zones or belts, on which it prevails in excess of all other trees The limits of these zones or belts being crossed, the forest may be traversed for hours without a single bullet-tree being met with, after which perhaps another zone is run into'

'Regarding the character of balata, Mr. Jenman quotes Dr. Hugo Muller, F R. S, as follows.'—

"Although my own opinion about balata, derived from personal experience, of its practical application in a few instances was entirely favourable, I thought it desirable to avail myself of an opportunity of obtaining a further opinion direct from an india-rubber manufacturer, considering that this would be much more to your purpose than anything I could say on my own account, hence the delay in my answering your letter"

"It seems then, that balata is by no means neglected and, in fact, it would find ready purchasers if more of it came to the market As it is the supply is very limited, and generally it comes only once a year It commands a higher price than gutta-percha, and this in itself is a proof of its usefulness It is used almost in all cases in which gutta-percha is used, but on account of its higher price only for superior purposes"

"It seems that balata is treated by the manufacturers simply as a superior kind of gutta-percha, and, therefore, its name disappears when manufactured

"Nevertheless, balata is distinctly different from gutta-percha, and this is especially manifested in some of its physical characters, for instance, it is somewhat softer at ordinary temperature and not so rigid in the cold"

"The chemical composition, however, is probably quite identical with that of gutta-percha and of caoutchouc"

"In one respect balata shows a very marked and important difference from gutta-percha, and that is in its behaviour under the influence of the atmosphere, whilst gutta percha when exposed to light and air soon becomes altered on the surface and changed into a brittle resinous substance, into which the whole of the mass is gradually converted, in the course of time balata on the other hand, is but slowly acted upon under the circumstances"

"I inclose a piece of balata tissue which has now been in my possession quite six years, and although it shows a peculiar mealy efflorescence, due to chemical change, it is still supple and coherent. A similar tissue of gutta-percha would have long before now become entirely converted into a brittle resin"

"The electrical insulating quality of balata is said to be quite equal to that of gutta percha, and altogether there seems to be no question about the valuable properties of balata All that is wanted is a sufficient and constant supply, and a somewhat lower price. But even at its present price I think, it would find a ready market if it came in large quantities, and thus enabled manufacturers to use it for applications on a large scale As far as I could make out, it is used by itself and not mixed with gutta-percha "

'The balata industry of this colony is in its infancy In Surinam the forests which have been bled are abandoned, and new lands are sought for and exploited up to late Only those areas where an abundance of trees is to be found have been selected On areas where 100 trees are found it sometimes happens that about 75 per cent only give milk at the particular period when the bleeder visits them and that at some later period the remaining trees will also run, but as the bleeders have gone beyond that particular section it is not profitable to come back and bleed the remaining trees just at the special time when they are ripe for it'

The forests are all the property of the Crown and are leased by the Colonial Government at a rental of 10c (1d) per hectare per annum for the exploitation of balata only, and that in conformity with the Balata Ordinance of the colony'

'There is no export duty whatever'

'The bleeder receives advances from his employers against which he contracts to deliver balata For his balata he receives from 50 to 55c (10d to 11d) per lb delivered on the concession. An average bleeder will gather about four gallons per day A very successful bleeder may get as much as 10 gallons during the same period In Surinam a bleeder will gather an average of 1 gallon per tree bleeding from the base of the tree up to a height of 20 feet and scarifying the back to half its circumference only, further scarification being illegal A gallon of milk will dry to about 4 lbs of balata"

'The bleeders are mostly recruited from Berbice, in British Guiana, and about 1 000 men are at present employed in this colony in the industry'

'The hot and very wet seasons are not good for balata bleeding The trees blossom in August and the seed drops about the month of November when the new leaf shoots out By the end of January the milk obtains the condition when it runs most plentifully The leaves of the old trees, the milk of which is not easily gettable, are dark-brown on the lower side and green above, the younger trees are light green on both sides During the flowering season the milk does not flow to any paying extent The leaves of the young trees are thick, and when broken the milk issues freely from the wounds After the month of August to the middle of January no work is done, this leaves about eight working months'

'Balata cannot be purchased in the market in Paramaribo. It is only gathered for those who employ balata bleeders, therefore, no quotation as to its price can be given, although it will be seen from the statistics of the exportation of this commodity, which the Colonial Government have very kindly placed at my disposal, that for statistical purposes a valuation is given The only certain thing that is known is, that the bleeder receives from some employers 50 and from others 55c per 1 lb for the balata which he produces on the concession Beyond this however, there are other expenses which must be added, such as commissions to foremen, loss by runaway bleeders, deaths, thefts, loss by capsizing of boats, cost of transportation surveying of concessions on occasions of dispute as to boundaries, assistance of pilots, Indian trackers, &c '

'*Return of Balata extracted from the Colony of Netherlands Guiana*'

Year	Quantity Kilos	Value Florins
1889	1,509	1,509
1890	76 326	95 407
1891	95,587	143 381
1892	120 680	181 019
1893	32 546	65 092
1894	108 286	216,573
1895	133,681	267,362

Amber.

Amber, once among the most prized of natural ornaments, is again coming into fashion Its praises are sung by the author of the "Tears of the Heliades,' * in prose which gives a correct and not unduly enthusiastic account of the history of the substance in fancy and fashion In a coloured plate of a necklace of Sicilian amber, with tints not only of yellow and orange but of iridescent greens, blues, and greys, he shows that some rare form of amber may really take the place of a 'gem" when properly polished and set Its beauty in a more concrete form may be seen in several of the leading jewellers' shops, where trinkets of the loveliest clouded yellow amber—cigarette-cases, powder-boxes and other small and costly articles of minor jewellery—are set with turquoise, diamonds, rubies, and sapphires in bands of small stones as evidence of the place in luxury which the amber may fill It is difficult to understand why its beauties have been forgotten It appealed to the æsthetic sense no less than to the imagination of the most primitive, and the most "decadent" of mortals, from the British chief who purchased it from traders over the sea, and had it buried in his tomb, to Nero, whose fleet brought back from the "Amber Shore" thirteen thousand pounds weight for his enjoyment, and who in his ode to Poppæa likened his wife's hair to its golden tints There is a wide range in the tints of amber, and the Roman ladies who dyed their tresses in imitation may have taken any shade from ripe apricot to lemon colour But in some aspect or another, fashion, fancy religion, or medicine, amber has never failed to attract the West until recent days, when an imperfect imitation of Oriental feeling has devoted it mainly to the service of smoke Its intrinsic merits are due at least as much to the sense of touch as of sight It is exquisitely light, and of a warm smoothness like no other substance Its electric properties heighten the feeling that this is no stone but the organic substance nearest to the chilly sovereignty of the gem, and superior to the gem because as Thales of Miletus said it has life ’ So Pytheas seeking the Amber Shore found Britain, and on the coast of Courland and from the Helder to the Elbe, the amber fishery and later amber mining have lasted from the founding of Olbia until to-day And Pliny knew though he did not express it scientifically that amber has the same specific gravity as sea-water, and travels with the current when the storms break up the submarine substances It rolls along, and seems to hang in the water

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* *Tears of the Heliades* *Amber as a Gem* By W A Buffum, London; Sampson, Low and Co,

It is in the nature of a miracle that the amber forests have perished or only survive as shapeless masses of carbon, while the balsam distilled from their branches remains perfect, in golden drops and honey-icicles ‘ Nothing but the straw and scum floats down the river of time, said the philosophers, ‘solid things perish or sink on the way But the amber, though Pytheas said it was the scum of the “encrusted sea,” is the essence of those perished forests overflowing life-drops from the giant trees. The coal and lignite are mere organic evidence of the past ‘ Here,’ we say, is coal —here, then, was a prehistoric forest ” It leaves on us no sense of a present in the past few striking records of the shapes or forms of the dead world, not the faintest relic of an episode not one vision of the play of life in those rolling ages of which it is the mute memorial But the amber drops that are the lively records of the life of this dead world In their transparent depths are enclosed the minute evidences of the days of the ancient amber-land, instantaneous photographs of incidents in the life of insects of leaves and seeds, of events so insignificant as to weigh but as dust in the balance in the course of the world as it was, but strangely interesting to us looking back from the world as it is Stories of forest life beneath these trees are present in the amber, of incidents as slight that we have as little right to expect their preservation as that of the wind in their branches,—moments of time measured by the falling of a drop or by the beating of an insect s wing Contrast this irreducible time-minimum of event with the immensity of the duration of the record of that event, and the attraction of the amber inclosures to the imagination may be in part explained It is not only, as Bacon says, that “ the

Spider, Flye, and Ant, being tender dissipable substances, falling into Amber are therein buryed, finding therein both a Death, and Tombe, preserving them better from corruption than a Royall Monument;" we also see the manner of their death, the nature of the falling amber, whether fluid, like water, or viscous, like honey, and the fly, extending its wings and making an instinctive movement to fly as the drop engulfed it. We judge the season of the year from the freshness or decay of the inclosed leaves, or the feathers shed by a moulting bird. It is not enough that the fossil-resin has preserved the seeds, the cone-scales and the tiniest leaflets of the forest, it has inclosed the insects which fed upon the leaves, and the spiders and the webs of the spiders which fed upon the insects. Thus, in the collection of *inclusa* at South Kensington, a clear drop of dark honey-coloured amber, incloses an insect on a tiny lanceolate-leaf. It resembles the cricket-like creatures found in long grass, the favourite prey of ground-spiders. The cricket was sitting on the leaf—uttering no doubt a thankful chirrup before he began his breakfast, when the amber rain descended, and there, like unhappy Ajax, *sedet æternumque sedebit*, life like though entombed, a cricket, perhaps ten thousand years old, nourished on leaves of which that inclosed with him is the sole survivor of what were once as thick as those in Vallombrosa. Next the cricket lies another of the midgets of the amber forest,—a tiny fly. It spread its wings as the drop fell and before it could make the down stroke of propulsion the liquid hardened and preserved it,—dead but a "living picture' of the miocene fly in action. The fly has for neighbour a spider, overwhelmed by the same fate, and, by a happy contrast of comparison of the ancient and the modern world beside these venerable flies and spiders, amber endowed with everlasting youth, are insects inclosed in the amber of to-day. It is not amber, but copal, shed not on the shores of the Baltic, but on the coast of Zanzibar. But it is amber in the making, not differing in appearance from the fossil gum; clear and pale like frozen honey, hard to the touch as amber. Yet it must have dropped from the trees like water, stiffening on the instant that it fell. For in the copal block is not one, or two, but a whole procession of imprisoned insects,—dead it would seem, while engaged in some social duty. Perhaps it is merely a procession, but it looks like a locust funeral, or the *déménagement* of an ant colony, in two lines, going and returning. Were they enclosed in Sicilian amber their value would be priceless in a Palermo shop, for the scene resembles exactly that universal ‘house-moving" of the poorer Italian families seen before Easter. It is a *sgomberamento* in amber. There were thirty kinds of pine in the amber forest, and we know this and guess the proportion of this or that to the other trees by the fragments found in the fossil sap which has survived its parent forest. The most common of all was a "Tree of Life," which has left five times as many fragments preserved in the amber as has any other pine. But oaks and willows, beeches, poplar, birch and alder, and even a camphor tree all flourished in the wood together, by the unimpeachable testimony of the amber museum. So, too, the entomologists and others have found a little preserve in what is known as the amber fauna. Among the spiders is the remarkable genus *Archæa*, which differs from the living species by the position of the eyes, by the extraordinarily large jaws, and by the head which is very distinctly separated from the breast. Some of the insects unite in themselves characteristics of several families or orders now living and present a form out of which in the later development of the animal world, two different forms proceeded. A feather proves that the amber forest contained birds, but of mammalia nothing has been found but a tuft of hair. Fishes and amphibious animals are also wanting. Frogs, lizards, and fishes are shown in amber, but they have been introduced by artificial means. Bubbles of air, and even drops of water, occur, and in Berendt's collection there was a spider in the translucent body of which the movible air-bubble could be seen to shift its place at every turn given to the piece."

The magic properties ascribed to amber were the natural result of its electric power. Yet this belief does not account for the wearing of a cube of amber by the Shahs of Persia as a protection against assassination, nor for its use as material for poison-detecting cups. In the former case the cube was said to have fallen from heaven, in the latter its organic origin was thought to disclose the presence of mineral poisons, and its colour to change when vegetable drugs were present in the wine. Nor has the magic of amber any relation to Meinhold's striking tale of 'The Amber Witch." The poor girl discovered a surface amber mine, and was able to make money enough to buy comforts for her father's house and to give to the poor of his parish. This was enough to rouse the suspicions of the horrible age when envy had always ready the terrible engine of the witchcraft trial. Those who can endure the perusal of these records of malignity may read them in "common form' in the pages of 'The Amber Witch."
—*Spectator*

India Rubber.

Mr H Kingsley writes as follows to the Editor of the *Spectator*. Sir,—I have read, as I am sure many West-Coasters will have read, with great interest your article in the *Spectator* of November 14th on indiarubber, and I should much like to ask the learned writer thereof if something might not be done to reinstate the rubber-vines in those West African districts where the wasteful way in which the natives have collected it has stamped the trade out, and whether this reinstating might not be effected by the judicious felling of timber at a slight expense, because, if done judiciously, the timber felled would be of value and help to pay expenses From what I have seen of the rich rubber districts of Western Africa, the stamping out of rubber in a district arises primarily from the native pulling down every rubber-vine he sees and cutting it up into small pieces with a view to putting those pieces round a fire and running the rubber into a calabash , or, when the vines are too strong for him to do this, making murderous wounds on them with his machete ; secondarily, it arises from the very trying habits of the *Landolphia* in insisting on starting life from a seed—it will not send out side branches if its top is cut off, and it will not send up shoots from its roots Now in dense African forests the chances of seeds are few and far between They fall upon the ground 150 ft or 200 ft below the region whereon the sunshine and the rain plays You may go for months through the great Forest Belt of Africa in a grim twilight gloom, seeing nothing day out and day in but countless thousands of bare grey tree-stems festooned with great bush ropes twined and twisted round each other and round the tree columns, as bare of foliage as a ship's wire rigging, and looking like some Homeric battle of serpents arrested at its height by a magic spell If your way takes you on to a mountain top and you look down on the country you have traversed you can hardly recognise it in the wild, luxuriant mass of beauty, redolent in colour and perfume, that stretches before you, the top of the forest , but if you keep on the level ground you will come now and again to an oasis of new life where one of the forest giants having grown above his fellows and so given the tornado a grip on him, has been destroyed He has been cast by the tornado wind a wreck to rot, or turned in a second from a glorious living thing into a seared skeleton by the tornado's lightnings. If you will carefully examine such an oasis of new life, caused by the sunlight and rain reaching the ground instead of the top of the forest, you will see thousands of young plants coming up, and among the medley you will, I think I may say, always see young rubber-vines A very few of these vines will ultimately survive ; only those, in fact, which by their wonderful hook-tackle arrangements have gripped on to the two or three saplings of great forest trees which are destined to win in the race for life with their neighbours, and take the place of the great fallen monarch tree and those round him which have been wrecked by his fall Of course, to carry out clearings in West African forests means the institution of a Forestry Department like that of India, and this for trade purposes is not immediately required ; for the quantity of rubber in West Africa is enormous. The *Kicksia*, the Lagos rubber-tree that has been brought so profitably forward by Sir Alfred Maloney and Sir Gilbert Carter of

Lagos, is by no means confined to Lagos. It grows in great luxuriance all along the South-West Coast, but at present the African does not know it is a rubber-tree down there, and confines his attention to the vines to *Landolphia Owariensis*, from which he gets the high quality rubber, to *Landolphia florida* from which he gets flake rubber, and to five other bush-ropes, from which he gets a sap which is not true rubber at all but which he uses with many other things to adulterate his rubber with, to the end of making it heavier because it is bought of him by weight, and it is his nature to adulterate everything that passes through his hands. A Forestry Department is however, a great need in those portions of the West African Coast that fringe the Western Soudan like the Gold Ivory and Slave Coasts. The forests here are only ringing forests between the Sea of Sand the Sahara and the Salt Sea or the Bight of Benin, and are in danger of being destroyed by the native in his terribly destructive way of making his farm—clearing a patch of bush cultivating it for a season then letting it go into a worthless jungle, and clearing another patch. Such disforested regions you will find round Acra and the Elmina Plain, and in those regions of this disforested land most remote from the Forest it is almost impossible now for the native to make a plantation whose yield is sufficient for his needs, because the destruction of the forests diminishes the rainfall—for example the rainfall at Acra is about forty-five inches per annum, and this is not sufficient to support a luxurious food-producing vegetation in a tropical district subjected to a long dry season and the intensely drying action of the wind from the Sahara, and if the destruction of the forests is allowed to go on at its present rate for a few more years, we shall find ourselves facing famine in West Africa. The South-West Coast, which commences at Cameroon, is under different climatic conditions. Cameroons with its volcanic island series of Fernando Po San Thomé, and Principe, has an infinitely richer soil and a heavy and evenly distributed rainfall, below Cameroons you are in the region of double seasons two wet and two dry, until you reach Congo, and in this double-season region the growth of vegetation is so rapid that the native has to fight back the forest as a Dutchman fights the sea, and moreover the mass of the South-West Coast natives are not so much dependent on plantations as those of the West Coast for they are nomadic hunters. I see you notice the German efforts to improve the producing power of Cameroons, and I should like to add that the French Government in Congo Française are equally active, and among other things have encouraged the planting of the para-rubber tree, which flourishes exceedingly.

The Reproduction of Loranthus.

It is a popular idea that the seeds of many plants pass unharmed through the digestive canal of birds, and, being voided with the excrements reach the ground in a peculiarly favourable condition for germination, and this is generally believed to be especially the case with the mistletoe, the seeds in this case being deposited on the branches of the tree on which the mistletoe is parasitic. In a paper contributed to the *Transactions* of the Linnæan Society, Mr F. W. Keeble shows that this is at all events not universally the case with the *Loranthaceæ*, especially with the Singhalese species of *Loranthus*. The species of this genus with tubular flowers, which are natives of Ceylon are ornithophilous, the bird most effective in their pollination being a honey-bird a species of *Nectarinia*. In the large-flowered species, the buds remain closed ; but when tipped, the corolla-lobes fly open with an explosion, and the pollen is scattered The closing of the flower-buds appears to serve the purpose of protecting the pollen against rain, while the violent expulsion of the pollen aids in its carriage by the visiting birds, their beaks being frequently found to be covered with pollen after visiting the flowers. When the fruit is ripe, the bird eats the succulent portion only, wiping out the seeds with its beak on a branch of the tree, to which they thus become attached by their viscid coating If swallowed, the seeds are found to be digested and destroyed.—*Nature.*

The Resin Industry.

In an article on the Naval Stores Industry, the Savannah *News* says :—

"As is too well known among those directly interested, the Naval Stores trade during the past three seasons has suffered from the effects of over-production, and the industry continues to suffer, being further depressed by the recent financial stringency, which greatly curtailed the domestic demand for spirits and resin. At present the prices of naval stores are low—in fact almost below the cost of production—but with the determination among operators to reduce the production, it is hoped that there is a bettter future."

According to the *L'Echo Forestier*, the same is so in France. Owing to over-production and the inability to compete with the low price of the American product, figures are lower than for thirty years. Improvements introduced of late years in the manufacture of naval stores do not seem to have brought about the results expected, and a number of establishments are disposed to return to the former less costly methods.—*The Forester*,

A New Fibre.

How many bankruptcies does it take to establish a new industry? British manufacturers are by all accounts among the most conservative of mankind and if the name "ramie" suggests anything to a Lancashire cotton-spinner it is the recollection that a great many people have dropped money over this particular fibre. Nevertheless, it seems probable that the British manufacturer will have to take ramie seriously. It is by no means a new invention; no one can say for how many centuries Orientals have used the fibre, which is found in the bark of a particular kind of nettle, to make themselves rough, strong cloths and nets or lines for their fishing. But as an article of European commerce it is so new as hardly to be counted among our imports, and though the plants which produce it have for many years been cultivated under European supervision, it has only been for the purposes of speculative experiment. The plants can be seen growing any summer at Kew; one of them, *Rhea nivea*, the Chinese variety, flourishes in the open air. It grows like a Michaelmas daisy in a clump of tall shoots springing from a perennial root, and has big palm-shaped leaves, with the under side white, like those of the wild guelder-rose or cherry apple. If you strip the bark from one of these shoots and fray it with a knife there is disclosed a white, silky fibre very fine in the strand and extraordinarily strong. What is called China grass is simply these ribbons of bark carefully decorticated by hand till the fibre is left bare. It is, however, still coarse and hard and the immensely laborious process of cleaning makes it cost too much to be of any use in general trade. The ramie of commerce, which is to supersede flax, hemp, and all other textile fabrics according to the true believers), is the same fibre more cheaply and better prepared from a tropical variety of the same species, *Rhea tenacissima*. This differs from *Rhea nivea* only in having a green leaf but the essential point of the matter is that it is tropical, and will produce at least four crops a year while the Chinese plant can at most yield two. The intrinsic value of the fibre has for a long time been fully admitted, so much so that the Indian Government twice offered a prize of £5,000 for rhea filasse of high quality produced at a limited cost. The prize was never won. The difficulty lay, as it has lain always, in the production, for which two distinct operations are necessary. First, the stems have to be stripped of their bark, which is done by hand or machinery, though no machine has yet been invented which does the work so well as the cheaply purchased Oriental hand labour. Secondly, in the ribbons so stripped off the fibre has to be disengaged from the gummy bark and this is only possible by a chemical process. No mechanical method can thoroughly separate the gum and the fibre, although at least two companies exist which aim at preparing ramie wholly by machinery. Various chemical processes were applied, all of which succeeded in turning out a clean 'filasse" of fibre, but unfortunately when the filasse was worked up into yarns, threads, or stuff, it was found to perish after a few months. The strong chemicals employed rotted the fibre. This happened particularly with the products of rhea prepared in France where about ten years ago great interest was taken in the matter. After the French, the Americans took it up and prophesied great things, but they also dropped money over it. Now it really seems that England is going to step in and solve the problem. Mr Gomess, a chemist trained in this country but of Indian origin has patented a method which turns upon the employment of zincate of soda. A company has been formed, patents taken out all over the world and a sort of experimental factory is actually at work in London which turns out about two tons a week of ramie ready for spinning.

The process is simple to the last degree. Two things have to be guarded against. First, fermentation of gum in the ramie-ribbons before they come to be manufactured; this is avoided by steeping them in a solution of soda. At present, of course, the preparation of these ribbons is by no means perfect since no regular market has existed for them. Now however in many tropical countries plantations of ramie are being set and in time planters will learn to send their ribbons carefully picked and cut with proper precautions against the fermentation which rots them. Secondly the chief trouble has been to find chemicals which would convert the ribbons into filasse with a sufficiently weak solution. This is what Mr Gomess has done. The ribbons are first steeped in tanks with a little infusion of nitric acid to soften the gum; after twelve hours of this they go into a bath of alkaline solution. Then they are boiled in a tank of water impregnated with the zincate of soda and what comes out is pure fibre, the gum and epidermis of the bark is completely dissolved. At no stage is anything used stronger than a 1 per cent solution. The filasse, when washed and bleached, may be mixed with inferior silk, or worked up by itself, and it can be sold at a profit for 3d a pound. Flax in the same stage of preparation costs from 8d to 1s. Thus the ramie-fibre can be sold almost as cheaply as the cheapest cotton; it has strength sufficient for any use and it will neither shrink nor stretch. It is very light, and as much sail-cloth can be made from six pounds of ramie as from ten pounds of flax; indeed its advantage in this respect has been already recognised. The Defender's' canvas was made of rhea-fibres which had to be bought up piecemeal in England and where woven in America. It will take dyes of all shades and from it are made fabrics resembling damask linen silk plush and tapestry. These were good enough to look at but all somewhat harsh to handle. It is fair, however to remember that the manufacture is in its infancy, and that the weavers do not yet know how to use the stuff to the best advantage But there seems no doubt that in the qualities of cheapness and durability it will be a real addition to the wealth of mankind The filasse is naturally so glossy that it seems specially fitted to compete with linen, and Belfast merchants would probably be well advised to look into the matter at once Silk it will probably never rival but it might very well sweep off the face of the earth all the innumerable cheap combinations of silk and wool, which are used in upholstery and the like , and for towels dish-cloths, and the whole paraphernalia of washing up it ought to be unsurpassable These, however are high matters, too hard for anything but the far-reaching experience of woman The most interesting point about ramie is that the new industry, when created may not improbably solve a very awkward problem in the management of Great Britain's enormous tropical estate

The West Indies are in a bad way as every one knows, because there is no price for sugar, and because the sugar-growing colonies have imported coolie labour to an immense extent Demerara for instance has half a million of them These coolies must, by the contract made with the Indian Government receive constantly their shilling a day, or else Demerara must pay their passage and expenses back to India Say that costs £10 a head. Demorara cannot get rid of her coolies without paying a fine of five millions , she must therefore go on sugar-growing whether she likes it or no But wherever sugar can be grown rhea can be grown also , and coolie labour is quite sufficiently skilled not only for cutting the crop and stripping the bark by hand or machine, but also for preparing the filasse There is everything to be said in favour of employing the Gomess process at the place where the crop is grown First, a plant which yields four or five crops a year exhausts the soil with great rapidity The fibrine is only 5 per cent of the whole, and the other 95 per cent should go back into the ground —the leaves as leaf-mould , the sticks after they have served for fuel, in the form of ashes. Secondly, the less chemicals used the better , and if the process is applied when the bark is soft and freshly peeled, a weaker solution will suffice to dissolve the gum Also, out of a ton of rhea-ribbons only 60 per cent of filasse is produced, so that to import filasse instead of ribbons would save 40 per cent of freightage. It is not to be supposed, of course, that any casual person can go and make his fortune by starting a ramie-farm But it does seem probable that much of the tropical soil and cheap labour which cannot be productively employed in growing sugar will be turned to this account. Practically, the question resolves itself into this,—Can rhea-fibre be produced cheaply ? And does any existing process produce it cheaply without impairing its qualities ? It is too early for a final answer But cloth made from fibre prepared by the Gomess process is two years old by now, and shows no sign of any defect ; nor is there reason to apprehend any, since no chemical of any injurious power is used in the preparation. And as to the cheapness, rhea-ribbons can be bought here for about £12 a ton, leaving a good profit to the grower, from these filasse can be produced, which will fetch about £50 a ton, having cost in all perhaps £30 to turn out. These are facts which every one would do well to consider who has an interest in the matter. To put the case concisely, ramie is a fibre which can supplant flax and compete with silk, and it can now be produced almost as cheaply as cotton. If that is true, as a careful inquiry leads us to believe it is, can the tropical colonies do better than cultivate ramie ?—*Spectator.*

Obituary—Dr. Herman von Nordlinger.

Our readers will hear with regret of the death of Dr. Herman von Nordlinger late Professor of Forestry at Tubingen and Hohenheim, which took place on the 19th January at Tubingen. He was 78½ years of age. The late Professor's admirable wood sections are two well known to need much comment. He published a set of 11 volumes of 100 each, besides special sets to the French Forest School at Nancy and for us at Dehra Dun.

VII.-TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

January, 1st 1897

East India Teak.—The importation of Timber and Planks has been:—

	1890	1891	1892
Importation	16 000 Loads	16 588 Loads	7 923 Loads
And the deliveries	17 140 „	14 371 „	10 455 „

	1893	1894	1895	1896
Importation	12 687 Loads	9 849 Loads	22 200 Loads	23 312 Loads
And the deliveries	12,646 „	10,620 „	18 399 „	21,941 „

In no branch of the wood trade has the unusual spectacle of heavy supplies and a great rise in prices been more apparent than in the course of the market for Teak Timber during the past year. Even as late as December 1895, there was little movement, but almost with the turn into 1896 cargo business began at an advance of 10s per load, and by the end of January the rise amounted to £2 per load, every available cargo being eagerly bought up. In February, the market became a little feverish with talk of higher prices still, but this died away, and the market was quietly held at the new level through the first half of the year, consumers fighting hard against paying the advance By the end of June it was evident that the demand justified the prices, and a steady business was carried on at them till the autumn In October rates began to move upwards again each sale being at a small advance on the previous one, and finally in the closing months of the year, another definite and considerable rise was established It is satisfactory to note that in spite of the enhanced cost the deliveries from the Docks in London for the year amount to some 22 000 loads against an average of 14 000 loads for the previous seven years. The trade in teak planks boards and scantling grows steadilly for general purposes but is of a much more retail nature than the trade in logs Looking back on the year it has to be remembered that the point from which the rise began was a low one, and that market is now high only in comparison with the years immediately preceding it It was far higher than it is now in the years before that when there were no Navy Leagues at home and no French Government naval programmes abroad

CEDAR —MALABAR —Shipments were limited to three small parcels (together 28 logs) the logs which were sizeable and fairly good sold well but when small and inferior prices were low To command better rates this wood should be of good length and pale in colour as well as sound and large Quotations are from 3½d to 4½d per foot

ROSEWOOD—EAST INDIA —The demand was rather quiet at the beginning of the year but recently there has been more enquiry The stock brought forward as well as the few small lots imported during the year all found buyers at good prices Stocks are quite exhausted and as supplies are asked for small shipments of large, good logs might be made Quotations are from to £8 to £10 per ton

SATINWOOD,—EAST INDIA —*Logs* were shipped moderately, and when figury sold well, but for plain wood prices were generally rather lower , figury *boards* were in demand and realized good prices Small shipments of *figury* logs or boards might now be made Quotation for logs are from 8d to 12d , and for planks and boards from 9d to 15d per foot

EBONY —EAST INDIA —Only three small parcels came forward and these sold readily and well The market is now bare, and small shipments of really good logs would bring full quotations, which are from £7 to £8 per ton

MARKET RATES OF PRODUCTS

Tropical Agriculturist, January, 1897

Cardamoms		per lb	3s 1d	to	3s 2d
Croton seeds		per cwt	77s 6d	to	80s
Cutch		,,	30s 3d	to	32s 6d
Gum Arabic, Madras		,,	37s 6d	to	45s
Gum Kino		,,	£45	to	£55
Indiarubber,	Assam	per lb	1s 10d	to	2s 4d
,,	Burma	,,	1s 4d	to	2s
Myrabolams	Madras	per cwt	3s 9d	to	5s 6d
,,	Bombay	,,	4s 3d	to	7s 6d
,,	Jubbulpore	,,	4s	to	6s 6d
,,	Calcutta	,,	4s	to	6s
Nux Vomica	Madras	,,	6s	to	7s 6d
Oil Lemon Grass		per lb	2¼d		
Orchella	Ceylon	per ton	10s	to	12s 6d
Sandalwood, logs			£30	to	£50
,,	chips	,,	£4	to	£8
Sapanwood,		,,	£4	to	£5
Seed lac			70s	to	80s
Tamarinds		,,	9s		

Statement of average selling rates of timber and bamboos in Moradabad, Bareilly Pilibhit Delhi Bulandshahr and Cawnpore for the month of December 1896

Description	Timber scantlings per score		Bamboos per 100 score		REMARKS
	From	To	From	To	
	R A P	R A P	R A P	R A P	
MORADABAD					
Sál 10 Tors (Poles)	20 0 0	25 0 0			
Sál and Sain &c { Sal	0 0 0	60 0 0			
Karis 12 × 5 × 4 { Sain	3 0 0	40 0 0			
Sál bed posts 7 × 2½ × 2½	0 8 0	0 10 0			
Bamboos of 9 to 10 per 100 score			50 0 0	75 0 0	
BAREILLY					
Sál 10 Tors (Poles)	5 0 0	10 0 0			
Sál and Sain &c Karis 12 × 5 × 4	25 0 0 40 0 0	35 0 0 50 0 0 60 0 0		–	
Sál bed posts 7 × 2½ × 2½	10 0 0	25 0 0			
Bamboos of 9 to 10 per 100 score			50 0 0	137 0 0	
PILIBHIT					
Sál 10 Tors (Poles)	33 0 0	60 0 0			
Sál and Sain &c, Karis 12 × 5 × 4	30 0 0	40 0 0			
Sál bed posts 7 × 2½ × 2½	4 0 0	5 0 0			
Bamboos of 9 to 10 per 100 score –			33 0 0	80 0 0 400 0 0	
DELHI					
Sál, 10 Tors (Poles)	5 0 0	7 0 0			
Sál and Sain &c Karis 12 × 5 × 4 { Sal { Sain	30 0 0 18 0 0	58 0 0 25 0 0			
Sál bed posts 7 × 2½ × 2½	8 0 0	9 0 0			
Bamboos of 9 to 10 per 100 score			20 0 0	75 0 0	
BULANDSHAHR					
Sál 10 Tors (Poles)	12 0 0	13 0 0			
Sál and Sain &c Karis 12 × 5 × 4 Sain	30 0 0	33 0 0			
Sál bed posts 7 × 2½ × 2½				–	
Bamboos of 9 to 10 per 100 score		–	48 0 0	56 0 0	
CAWNPORE					
Sál 10 Tors (Poles)	4 0 0	5 0 0	–		
Sál and Sain, &c, Karis 12 × 5 × 4"	24 0 0	42 0 0			
Sál bed posts, 7 × 2½" × 2½"	9 8 0	12 0 0	–		
Bamboos of 9 to 10 per 100 score –	–	–	26 0 0	45 0 0	

Extracts from the Times Summary of Trade of 1896.

Gums (Messrs S Figgis and Co London) —Excepting for a small speculative movement in Arabic and sudden rise in prices in the spring, there is little of interest to report Imports show a great falling off 530 packages being offered in sale compared with 1 450 packages last year Demand has been slow but prices show an advance of about 5s per cwt compared with last year. We have again to report a very active trade in kowrie with, as a general rule, advancing rates and we close at prices which show on the average 10s advance on pale re scraped 5s on amber and about 10s on dark amber, 5s to 7s on three quarter scraped 6s to 7s on half-scraped 2s to 3s on pickings Dark brown fine scraped and three-quarter scraped 10s to 15s part scraped and rough lots 5s to 7s 6d dearer Bush No 1 10s to 15s dearer, but Nos 2 and 3 practically unchanged Chips are 5s to 10s, and siftings and dust 7s to 8s per cwt dearer Imports and deliveries are about on par with 1895 Our stock as we close shows a reduction of upwards of 600 tons, and shipments from Auckland to all parts are on a still further reduced scale

Shellac (Messrs Reynolds and Sellers) —The past year has been most disappointing to holders and buyers all through prices showing, with very few exceptions a continual decline the closing quotations being the lowest of the year The shipments from Calcutta for the season 1895-96 were the heaviest on record being 128 102 cases—England received about 16 000 and the Continent 13 000 cases more than last year whilst America received 6,000 less Early in March reports came to hand respecting the Bysacke crop—April-June—which was anticipated to be a short one, and later advices estimated it as an eight annas against 13 annas last year In May this was further reduced to four annas with native sellers of previous cheap sales declaring default Owing to the drought in India advices came to hand in October reporting that the Coosmee crop would be affected Shipments for November were heavier than expected the dearness of money ruling in Calcutta influencing the natives to press their goods forward Business both for arrival and delivery has not been so large as in previous years button showing a great falling off Very little has been effected in fine and fine second orange, whilst A C Garnet has failed to prove an attraction Good second orange shellac now stands at 80s, against 102s a year ago A C Garnet at 80s., against 100s, and good third button at 72s against 90s During the year 55,362 cases have been landed, 48,354 delivered, and stock now amounts to 25 699 against 18 691 cases a year ago

Tanning Materials (Messrs Wittard Crip, and Co, London). —Mimosa Bark —There was not much stock at the beginning of the year, considerable quantities having been sold previously at a reduction to effect clearances The early prices at the opening were, for best ground Adelaide, £10 to £10 10s., and £1 less for moderate samples At midsummer the markets showed weakness, the outcome of which was a reduction of 20s., after which a slight revival took place Current values are now, for best Adelaide, £8 10s to £10, and Portland, £8 10s. Gamber has declined in value; the prices at the end of 1895 were 18s 6d to 19s. 6d., but in January 17s. 6d., was accepted; considerable business resulted, causing a partial reaction; afterwards a steady decline was experienced until in August quotations showed a drop of 1s 6d to 2s. per cwt Efforts were made to rally the market, but prices went in favour of buyers, and now may be quoted at 14s 3d for spot and a fraction less for arrival For Valonia a dull demand prevailed during the first half of the year, causing prices to recede, until good quality Smyrna was purchased at £8 16s to £9, in consequence of which large transactions took place for forward delivery, and the Smyrna market advanced This checked business; quotations, however, assisted by unfavourable reports as to the condition of the crop, advanced to £10 for good and £8 15s to £2 for fair quality. Lately a further rise has taken place

Teak (Messrs Denny, Mott, and Dickson, London) —Teak timber has advanced by leaps and bounds during the last 12 months, and the present import prices of £13 10s per load for Burma and £12 for Bangkok cargoes show a rise in prices of some 35 per cent as compared with those ruling at the commencement of 1896 Shipbuilders and other important consumers of this timber, who had become accustomed to the depressed prices of the last few years, have naturally been reluctant to respond to the increased pretensions of the teak shippers, and rumours of syndicates "cornering the market," both here and at the shipping ports, have been put about and caused friction in quarters where the broad facts of the position have not been appreciated. These facts, however, will be seen more clearly now that the figures for 1896 show a record consumption for Europe of some 80,000 loads, as against an average consumption of 50,000 loads for the previous four years, or an increase of some 60 per cent. The largely increased trade of the country caused an exceptionally good demand for teak, both for commercial shipbuilding and for rolling-stock construction. To the above general business demand must be added the constantly-increasing demand for teak for naval purposes Shippers assert that every possible log has been shipped to Europe during the past 12 months to meet the growing demand from this side, and that all the streams and watercourses from the Burmese and Siamese forests have been absolutely cleared of logs, so that the present season's limited supplies from the forests cannot be supplemented from "neaped" logs and old stored stocks, as in the case of past years, when the prices ruling in Europe have shown little or no inducement to shippers to press forward wood which they could afford to hold for a rise in the market. Every nerve seems to have been strained to push forward all available supplies, as of the about 68,000 loads imported to Europe during the year at least a third has been of a quality and conversion distinctly inferior to the standard of European squares"—a fact accounted for by the exhaustion of the stocks of first-class wood at the shipping ports having led to the stepping-in of outside speculators who have bought any wood procurable from the natives and shipped it to Europe regardless of quality in the hope that "anything" would sell on a rapidly-rising market This expectation has, whether wisely or not, been encouraged by some consumers on this side, who, smarting under an impression of being "cornered," sought to buy outside the usual channels The opening up of the Bangkok supplies has so widened the field for competition that it is now difficult to perceive any 'corner" being possible in teak, the more especially as every operator, however small, can now ship small parcels by steamer In respect to the present position the year opens with some 12 000 loads less of teak landed stocks in Europe than at the commencement of 1896, whilst the secured forward supplies afloat and chartered for show a total of 28,500 loads against 37,500 last year Supplies from the Burmese and Siamese forests are not expected to exceed 50,000 loads fit for shipment to Europe, but how far this may be added to by inferior shipments remains to be seen

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Coppice with Standards in the Vosges.

An Example.

The October and November Numbers of the *Revue des Eaux et Forets* contain articles on the above subject from the pen of M Henri Watier who has been making careful experiments on the cover of the standards, and who will be remembered as a keen forester and a good comrade by those who were at Nancy some twenty years ago Although the oak and beech referred to do not exist in India there are other trees to which M. Watier's ideas and methods may be applied, and I therefore reproduce the principal points of the articles in question

Not only in the Lower Vosges but also over a great part of France, and in other countries, too, the conditions of forest supply are changing Formerly the standards produced a certain amount of timber which was mostly used up locally, while the firewood was necessary in large quantities to maintain numbers of local factories, foundries glass works &c But the tendency of modern commerce has been to extinguish these small industries in favour of a few very large concerns using coal At the same time, the improvement and increase of sawmills, and the immense development of the railway network, make it possible, and, indeed, necessary, to transport the forest produce to those places where the density of the population demands it. The result is, that the *importance of the standards has greatly increased, while that of the coppice has diminished.* Why not then, convert to the seedling régime? The answer is, that in some cases it is impossible, or inadvisable, in others, the necessity for a more or less difficult and doubtful experiment is not distinctly proven. In fact the simplicity and order of the coppice method are not to be lightly abandoned, especially as the trade appears still to prefer moderate sized goods to handle, in the case in point *The problem thus is, how to preserve the advantages of the coppice method, while producing the greatest possible number of standards* Several solutions have been proposed, mostly based on the cover of the standards The "balivage normal" of M Purel may be selected as the type of these It depends upon exact calculations of the area strictly necessary in order that the coppice may produce the number of likely stems required for the annual reservation, neither more nor less The method is a purely speculative one involving numerous experiments on the cover and increment of the trees and endless calculations M Watier has marked one or two coupes according to this system but the result remains to be seen

Naturally the present discussion only refers to forests on soil capable of producing a considerable amount of large timber.

The forests in which M Watier's experiments were made are those of Aingeville, Bulgneville, Mandres-sur-Vair Vaudoncourt, and Parey-Saint Ouen situate about 12 miles from Neufchateau. The principal work was done in the three first mentioned which were chosen especially on account of the proportion of oak standards they contain Aingeville is pure oak, Bulgneville has 75 per cent. oak with 25 per cent beech, while Mandres has half and half.

Aingeville—Coupe No 4 is a forest of the plains of 4 hectares 35 ares containing coppice 29 and 30 years old growing on the Gryphæa limestone Its production is estimated at 15 stères of billets and 700 fagots or 40 cubic metres per hectare The reserve is consituted as follows —

I Class 368	222 Oaks
(34 per hectare)	2 Beech
	156 Various
II Class 314	310 Oaks of 0 88 girth
(72 per hectare)	1 Beech
	2 Hornbeam
	1 Aspen
III Class 40	20 Oaks of 1 25 girth
(9 per hectare)	13 of 1 50
	4 of 1 75
	3 of 2 00

Exclusive of the I Class the yield amounts to—

II Class	217 *m* c	317 *m* c or 75 *m* c per hectare
III Class	110 *m* c	

The reserves abandoned contain—

146	Oaks and	8 Various,	of 0 50 girth
81	" "	6 "	" 0 75
68	" "	" ,	, 1 00
29	" "	1 Beech	" 1 25
9	" "	" "	" 1 50
9	" "	" ,	" 1 75
2	" "	" "	" 2 00
344		15 Various	

The volume of which bole and crown amounts to 230 *m* c., of which 324 *m* c is oak, or 53 *m* c. per hectare

The coupe thus contains just before the felling a total volume of—

128 *m. c.* per hectare in Classes II. and III.
5 " " " Class I
45 " " " Coppice
—
178

Bulgneville—Coupe No 12, of 5, *H*, 59, *A*., aged **25 years**, (that being the rotation here), situate on a lower lias sandstone plateau an excellent forest soil, estimated at 15 stéres of billets and 600 faggots, or 40 *m c*, per hectare. The constitution of the reserve need not be given here It is given in tabular form lower down, where, however, the "various" are classed as oaks, for the reasons there stated The details above given for Aingeville will suffice for those who may attempt similar work in this country.

The volume of the reserve is:—

II	Class, Oak and Ash	123 *m. c*	156 *m. c.*
	Beech and Various	33 *m c*	
III.	Class, Oak and Ash	213 *m. c.*	275 *m. c.*
	Beech	62 *m. c.*	
			431 *m. c.*

or 77 *m. c.* per hectare.

The trees abandoned comprise 196 oak and ash, 69 beech, and 15 various These 280 trees yield—

Oak and Ash	253 *m c.*	351 *m c.* or 63 *m. c.* per hectare.
Beech and Various	98 *m c*	

The coupe thus contains, just prior to the felling—

140 *m c* in Classes II and III.
40 *m. c.* in Coppice
5 *m. c* in Class I.
—
185 *m. c.*

Mandres—Coupe No. 10, same situation and soil, 5, *H*, 94, *A*, aged 35 and 36 years, estimated to produce 10 stéres of billets, and 600 faggots or 37 *m c* per hectare. The reserve comprises oak, beech and others, I Class 585 II Class 372, III Class 95, with a volume, excluding class I, of 589 *m c*, or 99 *m. c.* per hectare The trees abandoned are 492, with a volume of 667 *m. c.*, or 109 *m. c* per hectare.

The coupe thus contains, just prior to the felling—

208 *m. c* per hectare in Classes II and III
37 in Coppice
5 in Class I.
—
250 *m. c.*

The cover of the Standards.—It was taught by Messrs Lorenz and Parade that on good soils, just before the felling, the standards ought never to cover more than one-third of the surface. The propriety of this principle has been contested, by Messrs Puton and Bartet among others. The three selected coupes abovementioned, being on good soil, it becomes interesting to see what is the cover of the reserves in them. By cover is meant the area of the horizontal projection of the crown. In practice this is taken as the area of the circle described round the mean diameter of the horizontal projection. This mean diameter is found with sufficient exactitude by taking two diameters at right angles to one another. Accordingly M Watier measured these two diameters for each tree in the three coupes referred to which may be called "*exploitable coupes*." But, rightly suspecting important differences, he was induced to make similar measurements in the preceding ones which had been felled over and contained a two year old regrowth. These coupes may be called '*exploited coupes*." The trees were classed by species and size as follows. In the *exploitable coupe*, a mean girth was found for the trees of Class II (or of two rotations), the reserves of Class III and upwards were divided into groups at intervals of 0 25 beginning with a girth of 1 25 and the abandoned trees into groups at intervals of 0 25 beginning at 0 50. The reason for separating the trees abandoned from those reserved is, that it is a rule, in marking a coupe that whenever there is a choice between two trees of the same size, the one with the better developed crown is reserved and the other abandoned. In the *exploited coupe* the trees were divided into groups at intervals of 0 25 beginning at 0 50 girth. The number of trees measured was 1,312 oaks 408 beech and 40 various. These last, being so few, have been classed as oaks without introducing any appreciable error.

The following are the results of measurement in the exploitable coupes :—

AINGEVILLE

Classes and number		Diameter D of the crown	Cover $\frac{3\ 14}{4}$	Cover per Class	Cover of the trees reserved	Cover of the trees abandoned.	Total Cover
		Metres	Sq m	Ares	Ares	Ares.	Ares.
314 Oaks Class II		3 6	10	31 14	45 47 or 10 %		78 78 or 18%
20 ,, of	1 25	6 0	28	5 60			
13 ,, ,,	1·50	6 3	33	4 29			
4 ,, ,,	1 75	3 0	64	2 56			
3 ,, ,,	2 00	9 2	66	1 98			
154 Trees ,,	0 50	2 0	3	4 62	...	33 31 or 8%	
87 ,, ,,	0 75	3 0	7	6 09			
68 ,, ,,	1 00	4 1	13	8 84			
30 ,, ,,	1 25	5 1	20	6 00			
9 ,, ,,	1 50	6 4	32	2 88			
9 ,, ,,	1 75	7 3	42	3 78			
2 ,, ,,	2 00	8 4	55	1 10			

It would take up too much space to give the detailed figures for Bulgneville and Mandres, suffice it to say that in the former the reserves cover 80·82 ares, or 14% the trees abandoned cover 54·47 ares, or 10% and the total cover is 1 hect 35 29 ares In Mandres, the reserves cover 1 hect 29 58 ares, or 22% the trees abandoned cover 1 hect 06 24 ares or 23% and the total is 2 hect. 64 82 ares, always exclusive of the 1st class, or trees of the age of the coppice Thus, the 128 *m c* of Aingeville cover 18 ares, the 140 *m c* of Bulgneville cover 24 ares, and the 208 *m c* of Mandres cover 45 ares. The disproportion between the volumes and the areas is due to the composition ; at Aingeville there is a large number of small oaks half smothered in the coppice, while at Mandres there are more large trees including beech, which have the mastery over the coppice The point is this that the maximum cover found was 45 ares for 208 *m c* whereas M Bartet, in his investigations found that volumes of 80 to 90 *m c* covered 61 to 63 ares The discrepancy requires explanation, and can only be due to the fact that M Bartet must have measured his cover in exploited coupes instead of in exploitable ones It thus becomes of interest to see what would be the cover of the reserves, had it been measured *after* instead of *before* the felling. This is shown in the following table —

AINGEVILLE.

Classes and number	Diameter D of the Crown	Cover $\frac{3\ 14}{4}$	Cover per Class	Cover of the trees reserved	Cover of the trees abandoned	Total Cover.
	metres	sq m	h a	h a	h a	h a
314 Oaks II Class	7 4	48	1 35 02	1 66 52 or 38%		2 83 65 or 65%
20 Oaks of 1 25	9 0	64	12 80			
13 ,, 1 50	10 3	83	10 79			
4 ,, 1 75	11 5	104	4 16			
3 ,, 2 00	12 6	125	3 75			
154 Trees of 0 50	4 6	17	26 8		1 30 14 —13 01* 1 17 13 or 27%	
87 ,, 0 75	6 5	33	28 71			
68 ,, 1 00	8 3	54	36 72			
30 ,, 1 25	9 0	64	19 20			
9 ,, 1 50	10 3	83	7 47			
9 ,, 1 75	11 5	104	9 36			
2 ,, 2 00	12 6	115	2 50			

Bulgneville and Mandres are similarly treated In the former, the figures work out as follows cover of the reserves 1 hect. 72 87 ares or 31% cover of the trees abandoned, 1 hect 18 96 ares, or 21 % total 2 hect 91 83, or 52 % In Mandres, the cover of the reserves works out to 2 hect 00 08, or 34 per cent., the cover of the trees abandoned to 1 hect 91 22, or 32 per cent., total 3 hect 91 30, or 66 per cent

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* The same units of cover having been applied alike to the reserved and to the trees abandoned, a deduction of 10 per cent is made from the latter, as was done by M Bartet.

The results thus differ widely for trees of the same girth, according as their cover is measured just before or soon after a felling Thus, per hectare —

At Aingeville,	18 ares *before*,	65 ares *after*	the felling
Bulgneville,	24 ,,	52 ,, ,,	,,
Mandres,	45 ,,	66 ,, ,,	,,

from which it may be concluded—

I That the cover of standards varies widely according as it is measured before or after a felling,

II That there is a great expansion of the crowns immediately after a felling,*

III That this expansion is much greater in a young crop than in an old one,

IV That in the exploitable coupe the dictum of Messrs. Lorenz and Parade is not far out and they themselves laid it down as an approximation only

The Coppice Rotation—When the circumstances soil, &c, permit, the rotation should always be a long one 30 years or more. Doubtless, a short rotation isolates the standards more often, and they take on a sudden increment each time, but the benefit of this is neutralised by the injury to the coppice, and by other disadvantages Until the age of 18 years the coppice furnishes little more than brushwood of little value while after this age the brushwood begins to turn into billets, having a much higher market-value Evidently at 30 years old the proportion of billets will be very considerable and in the Vosges the value of billets is about double that of brushwood per *m c* As an instance may be cited the coupes of Vrecourt in 1891 94, which sold for 1,600-2,600 fr per hectare, while the 20-year old coupes of the locality brought in less than half With a rotation of 30 years, the first class stems reserved for the first time are strong enough to resist atmospheric influences which is absolutely necessary if an intensive culture is aimed at Short rotations frequently provide a pitiable spectacle of young stems unable to bear the weight of their own crowns A long rotation alone can furnish boles long enough for all uses many otherwise fine logs selling for a small price because of their shortness The coppice also suffers less from the cover to the standards under a long rotation than under a short one, since a crown of given area does far less harm when it is high up than when it is low down

The increment of the standards—In 1886-87, with a view to carrying out the ' balivage normal" of M Burel, M Watier took the trouble to measure the size, the height, and the cover, of some

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* This, with its accompanying increase in volume, is a fact having a certain bearing on the "Thinnings controversy,—vide Nov. No, pp 433 5,

4000 standards He duly carried out the Burelian ideas, and though this fact has no particular interest for us at present, there are some correlative results that may be of service

Coupe No 7, Canton de l'Etang Forest of Parey, cut in 1885, had been last cut in 1839 It was now found to contain 748 *m. c.* in the standards of Class II and over Allowing for losses by accident, to the extent of 25% in the 1st Class and 5% in the IInd Class, it was shown as the result of M Watier's measurements, that the reservation of 1889 had been as follows .—

21	Oaks	Age	25	Yrs	Girth	0 30	Hght	4 *m*	Volume *m c.*	15 1
221	Beech		25	,,	,,	0 30	,,	4 ,,		
84	Hornbeam		25	,,	,,	0 30	,,	4 ,		
140	Oak		50	,,	,,	0 53	,,	5 *m*	Vol 14 0 *m c*	86 2 ×1 9 =168 8
60	,,		75	,,	,,	0 94	,,	6 ,,	,, 21 2	
24	,		100	,	,,	1 41	,,	7 ,,	,, 21 2	
16	,,		125	,,	,,	1 88	,,	8 ,,	,, 29 8	
97	Beech		50	,,	,,	0 78	,,	6 ,,	,, 24 1	32 8× 2 1= 68 9.
8	,,		75	,,	,,	1 47	,,	8 ,,	,, 8 7	
										248·0

The figures 1 9 and 2 1 are factors or coefficients ; 1 9 applied to oak or hornbeam boles gives the volume of the whole tree ; 2 1 applies to beech in the particular locality.

The above table shows that in 27 years, 248 *m. c.* or 66 *m c.* per hect became 748 *m c* or 200 *m c* per hect. For every *m c* reserved in 1839 3 *m c* were found in 1886.

The annual increment of the standards therefore is $\frac{200\quad 66}{27} = 5$ *m c*

Coupe No 7 Canton de la Rippe, Forest of Vaudoncourt, was similarly treated The loss by accident was put at 20 % for 1st Class stems, and 3 % for 2nd class the reserves generally being less numerous than at Parey, and so much the less likely to get damaged in the fellings Here it was found that 165 *m c* per hect reserved in 1838, became in 28 years 423 *m c* or 99 *m c* per hect., 1 *m. c.* becoming 2 6 *m c*, the mean annual increment therefere was $\frac{99-38}{28}$ $= 2\ 2$ *m c* per hectare

Coupe No 8 of the Communal Forest of Velaine-sous-Amance is referred to by M Broilliard in his Aménagement. Here, 56·6 *m c* and 56 steres of branchwood in 25 years became 185·2 *m. c.* of stems and 132 steres of branchwood. Here, in 25 years 1 *m. c.* becomes 2 4 *m c*, in 30 years it would become 2·7 *m c.*

From the above facts it may be concluded that in 30 years, on good soil, the reserves triple their volume, perhaps a little less if they are purely oak For some years past the older classes have been numbered and belted. The extension of the practice to the 2nd. Class trees of all species would supply most valuable data by the end of the rotation. In some parts of India the practice exists of numbering the whole of the standards, which actually does prevent thefts fairly efficiently for a year or two, but the full benefit of the work is lost because the staff is too weak to ever verify the standards remaining in any coupes older than the recent ones, and as a matter of fact not only do the numbers disappear, but the trees themselves do the same.

Maximum volume of the reserve.—In the five coupes already mentioned, the volume of the standards was, at the time of felling :—

Aingeville	126 *m. c.*	per hect.	for a rotation	of 30	years
Bulgneville	140	...	...	.. 25	„
Mandres	208	...	...	. 35	„
Parey	200		...	... 27	„
Vaudoncourt	100	.	. .	. 28	„

In coupes like Aingeville, Bulgneville and Vaudoncourt it is evident that the standards might well be more numerous; in the other two, the area left for the coppice seems reduced to its minimum. In No. 9 of the reserve quarter of the forest of Saint-Ouen the coppice is aged 25 to 31 years, in oak and beech. The area being 10 hect. 21 ares, the standards amount to 853 *m. c.*, the abandoned trees to 1464 *m. c.*, total 230 *m. c.* per hectare. This coupe is bastard high forest, one half of the area being without coppice. Hence it is apparent that 230 *m. c.* per hect. is too much, while 200 *m. c.* per hect. leaves enough coppice to furnish the requisite 1st Class stems for reservation. Thus the condition to aim at in marking is, to have 200 *m. c.* per hectare, covering about 40 ares, in the coupe when exploitable. To obtain this stock it will be necessary to reserve 65 to 70 *m. c.* per hectare, if the forest is oak and beech, 75 to 80 *m. c.* if it is pure oak. Once the reserves are thus constituted the felling will be 120 to 135 *m. c.* every 30 years while the mean annual increment will be 4 to 4.5 *m. c.*

Proportionate numbers of standards. Wastage.—Every stem reserved does not become a mature tree any more than every child becomes a man. There are always some that perish by nature or accident. It is therefore necessary to know what allowance must be made for this waste in each class. Though small in the older classes, it is considerable in the youngest. Hence in order to make sure of the 70 or 80 *m. c.* per hectare required to develop into 200 *m. c.*, it is necessary to reserve a certain proportion in excess, to allow for disappearances accidental or designed. What is this proportion? It varies for each class of each species and must be determined on the spot. There is thus a *coefficient of survival*, namely, the proportion which the trees that reach maturity bear to the number originally reserved. If we have to reserve 100 trees of one class in order to obtain 89 trees of the next higher class, the co-efficient is 8. M. Watier found that the co-efficient for first reservations varied from 90 to 75, according to the local chances of breakage or death, while that of the older classes went down as low as 40 on account of the inclusion of short-lived species exploitable at 60 years. He recommends therefore that the necessary 75 to 80 *m. c.* for oak and 65 to 70 *m. c.* for beech and oak should be reserved in due proportion among the superior classes, with about 100 young stems additional at each felling.

The co-efficients of survival for standards may be applied as follows :—

100 I Class reserves give 100 × 0 8 = 80 trees 30 years old
80 II Class „ „ 80 × 0 6 = 48 „ 90 „ „
40 III Class „ „ 48 × 0·7 = 36 „ 120 „ „
36 IV Class „ „ 36 × 0 652 = 23 „ 150 „ „

The volume of these might be :—

23 Trees of 2 09 *m.* girth, at 4 6 *m c.* = 106 *m. c.*
36 „ „ 1 50 „ „ 2 3 „ = 83
48 „ „ 1 00 „ „ 0 9 „ = 43
80 „ „ 0 50 „ „ 8 2 „ = 16
248

But this is too much, as the maximum has been already put at 100 *m. c* The above figures must therefore be reduced in the proportion of 248 to 200, or four-fifths. Thus, making 80 first reserves, we shall get—

19 trees of 2 00 Girth, at 4 6 *m. c.* = 87 *m c.*
29 „ „ 1 50 „ „ 2 3 „ = 67 „
38 „ „ 1 00 „ „ 0 2 „ = 48 „
65 „ „ 0 50 „ „ 0 9 „ = 13 „
201

Of this number, the felling would include :—

19 trees at 4 6 *m. c.* = 87 *m. c.*
29—19 = 10 „ „ 2 3 „ = 23 „
38—29 = 9 „ „ 0 9 „ = 8 „
65—38 = 27 „ „ 0·2 „ = 5 „
128

And the reservation would include :—

19 trees at 2 3 *m. c.* = 44 *m. c.*
29 „ „ 0 9 „ = 26 „
38 „ „ 0 2 „ = 18 „
80 stems ... ...
78

Measurement of the cover—The division of the standards into size classes, and the measurement of their girth at breast height, have already been explained. The measurement of the cover is done as follows Two guards are provided with a staff each and a tape. One guard places his staff directly under one edge of the crown, and holds the end of the tape touching it. The other guard goes to the other side of the crown, and takes the reading up to his own staff similarly placed They then repeat the operation at right angles. The officer carries a plumb line, and sees that the positions are correct. It is best to employ six men, four to measure the two diameters of the crown one to take girths, and one to keep the register.

Relation between diameters of crown and stem.—Let the diameter of the crown be represented in the exploitable coupe by **D** and in the exploited coupe by D, the diameter of the stem being d, The results are shown in the following tables

Table I—Cover of oak in the exploitable coupe

Diameter d of bole.	Aingeville		Bulgneville		Mandres		Remarks
	Diameter **D** of Crown	Relation $\frac{\mathbf{D}}{d}$	Diameter D of bole	Relation $\frac{\mathbf{D}}{d}$	Diameter D of bole	Relation $\frac{\mathbf{D}}{d}$	
0 20	2 4	12 0	2 5	12 5	2 7	13 5	All measurements are in metres & centimetres **D** is the mean of the trees reserved and of those abandoned d is taken at breast high The above remarks apply to all the tables
0 25	3 0	12 0	3 3	13 2	3 2	12 8	
0 30	3 8	12 7	3 9	13 0	4 1	13 7	
0 35	4 5	12 8	4 6	13 1	4 8	13 7	
0 40	5 3	13 2	5 3	13 2	5 5	13 7	
0 45	6 0	13 3	6 0	13 4	6 3	14 0	
0 50	6 5	13 0	6 7	13 4	7 1	14 2	
0 55	7 5	14 6	7 4	13 5	7 9	14 3	
0 60	8 5	14 2	8 1	13 5	8 6	14 3	
0 65	9 2		8 6	13 4	9 0	13 8	
0 70			9 2	13 1	9 5	13 6	
0 75			9 6	12 8	9 9	13 2	
0 80			10 0	12 5	10 5	13 1	
0 85			10 5	12 4			
0 90			11 2	12 4			
0 95			12 0	12 5			
1 00			12 7	12 7			

Table II—Cover of oak in the exploited coupe

Diameter d of bole	Aingeville		Bulgneville		Mandres	
	Diameter D of crown	Relation $\frac{D}{\mathbf{D}}$	Diameter D of crown	Relation $\frac{D}{\mathbf{D}}$	Diameter D of crown	Relation $\frac{D}{\mathbf{D}}$
0·20	5 3	26 5	5 2	26 0	4 9	24 5
0·25	6 5	26·0	5 6	22 4	5 4	21 6
0·30	7 6	25 3	6 6	22 0	6 1	20 3
0 35	8 5	24 3	7 5	21 7	6 8	19 4
0 40	8 9	22·2	8 2	20 5	7 5	18·7
0·45	9 5	21 1	9 0	20 0	8 4	18 6
0·50	10 3	20 6	9 9	19 8	9 4	18 8
0 55	11·0	20 0	11 9	21 6	10 6	19 3
0 60	11 7	19 6	13 2	22 0	11 3	18·8
0·65	12 4	19 1	13 4	20 6	12 7	19 5

Table III—Relation between the diameters of the crowns of oaks in the exploitable and exploited coupes.

Diameter d of bole	Aingeville			Bulgneville			Mandres.		
	Diameter D of crown in coupes exploited	Diameter **D** of crown in coupes exploitable	Relation $\frac{D}{\mathbf{D}}$	Diameter D of crown in coupes exploited	Diameter **D** of crown in coupe exploitable	Relation $\frac{D}{\mathbf{D}}$	Diameter D of crown in coupes exploited	Diameter **D** of crown in coupes exploitable	Relation $\frac{D}{\mathbf{D}}$
0 20	5 3	2 4	2 2	5 2	2 5	2 1	4 9	2 7	1 8
0 25	6 [illegible]	3 0	2 2	5 6	3 3	1 7	5 4	3 2	1 7
0 30	7 6	3 8	2 0	6 9	3 9	1 7	6 1	4 1	1 5
0 35	8 5	4 5	1 9	7 5	4 6	1 6	6 8	4 8	1 4
0 40	8 9	5 3	1 7	8 2	5 3	1 5	7 5	5 5	1 4
0 45	9 5	6 0	1 6	9 0	6 0	1 5	8 4	6 3	1 3
0 50	10 3	6 5	1 6	9 2	6 7	1 5	9 4	7 1	1 3
0 55	11 0	7 5	1 5	11 9	7 4	1 5	10 6	7 9	1 3
0 60	11 7	8 5	1 4	13 2	8 1	1 6	11 3	8 6	1 3
0 65	1 4			13 4	8 6	1 6	12 7	9 0	1 4

Table IV—Cover of Beech in the exploitable Coupe

Diameter d of bole	Bulgneville		Mandres	
	Diameter D of Crown	Relation $\frac{D}{d}$	Diameter D of Crown	Relation $\frac{D}{d}$
0 20			4 6	23 0
0 25	5 8	23 2	5 6	22 4
0 30	6 5	21 7	6 4	21 3
0 35	7 1	20 3	7 2	20 6
0 40	7 6	19 0	7 8	19 5
0 45	8 1	18 0	8 5	18·9
0 50	8 7	17 4	9 1	18 2
0 55	9 4	17 1	10 2	18·3
0 60	10 2	17 0	10 9	18 2
0 65	11 7	17 4	11 1	17 1

Table V—Cover of Beech in the exploited Coupe

Diameter d of bole.	Bulgneville.		Mandres.	
	Diameter D of Crown.	Diameter D/d	Diameter D of Crown.	Relation D/d
0·20			5 8	29 0
0·25	8·0	32·0	6 6	26 4
0 30	8 5	28·3	7 3	24·3
0 35	9·2	26 3	8·1	23 2
0 40	10 3	25·7	9 0	22 5
0·45	11·0	24·4	9 9	22 0
0 50	11 4	2 ·8	10 7	21 4
0·55	12 0	21·8	11 7	21 3
0·60	12 5	20 8	12 3	20 5

Table VI—Relation between the diameters of the Crowns of Beech in the exploitable and exploited Coupes

Diameter d of bole	Bulgneville.			Mandres		
	Diameter D of crown in Coupe exploited	Diameter D of crown in Coupe exploitable	Relation D/d	Diameter D of crown in Coupe exploited	Diameter D of crown in Coupe exploitable	Relation D/d
0 20				5 8	4 6	1·3
0 25	8·0	5·8	1 4	6 6	5 6	1 2
0 30	8 5	6 5	1 3	7 3	6 4	1 1
0 35	9 2	7 1	1 3	8 1	7 2	1·1
0 40	10 3	7 6	1 4	9 0	7 8	1·2
0 45	11 0	8 1	1 4	9 9	8 5	1·2
0 50	11 4	8 7	1 3	10 7	9 1	1·2
0 55	12 0	9 4	1 3	11 7	10·2	1·1
0 60	12 5	10 2	1 2	12 3	10 9	1 1

From the above tables certain conclusions may be drawn. It has been already stated that the cover of the tree abandoned to felling is, or should be, smaller than that of the tree reserved. Table I shows that for oak and light-demanding species the relation $\frac{D}{d}$ in the exploitable coupe is fairly constant, increasing slightly with the diameter of the tree up to 0·55 *m.* and then again decreasing.

Table II shows that in the exploited coupe the relation $\frac{D}{d}$ diminishes as the diameter of the trees increases, but it remains always greater than the corresponding relation $\frac{D}{d}$ in the exploitable coupe.

Table III shows that the relation $\frac{D}{D}$ between the diameters of crown of tree of the same size in the exploitable and exploited coupes, varies inversely with the size of the trees It is always greater than unity, and varies from 1 3 for old trees to 2 for young ones.

Immediately after the felling, the oak crowns, no longer confined in the coppice, suddenly spread out For trees of 0 20 diameter of stem, the diameters of the crowns are as 2 to 1 and the areas as 4 to 1 Hence the necessity of distinguishing clearly between measurements taken in an exploitable, as against an exploited, coupe Any confusion on this point must lead to grave error There is, of course a direct causal relation between the expansion of the crown and the increment of the stem, but it is not necessary to assume that the increase of crown carries a corresponding increase of leaf surface Indeed, this is not proved, but whether it be so or not, the leaves, even without any increased surface, obtain a much greater share of light and heat, which translates itself into increased activity and corresponding increase of wood manufacture The relation $\frac{D}{D}$ shows how much a light-demanding species suffers, not only from the surrounding coppice, but from the reserves of other species notably those with heavy cover

Therefore attention must be paid to the due spacing of the former, and if the fellings are preceded by thinnings, advantage should be taken of the opportunity to free a sufficient number of promising stems for the future standards

The remaining three tables refer to beech a shade-bearing species Table IV shows that in the exploitable coupe the relation $\frac{D}{d}$ varies inversely with the size of the trees, but it is always greater than the corresponding relation for oak It follows that for trees of the same size, the beech has always a larger crown than the oak This is natural, since the beech refuses to let itself be oppressed by the coppice Tables V and VI together show that in the exploited coupe the relation $\frac{D}{d}$ again varies inversely with the size of the trees. For trees of the same size, it is always greater than the corresponding relation $\frac{D}{d}$ in the exploitable coupe. The same two tables show that the relation $\frac{D}{D}$ between the diameters of crowns of trees of the same sized trunk in the exploitable and exploited coupes varies inversely with the size of the trees It is always less than the corresponding relation for oak. Thus, like the oak, the beech puts on a rapid increase after a felling, but to a less degree than the oak, because it was in less need of release. Age for age, the beech is always larger than the oak, one reason being that it does not suffer its neighbours to encroach. The oak does, and for this reason it is found necessary to specially free periodically certain historic oaks in the forest of Saint-Ouen-les-Parey. It may be of interest to mention these oaks: they are the *Chene des Partisans* 7·40 girth; the *Chene Henri*, 5·20 girth; the *Chene Charles* X, 5·25 girth, and the *Chene de la Republique*, 5·0 girth; not a bad show for one forest. In marking a coupe, this expansion of the crown must be borne in mind, and the spacing carefully attended to, or it may happen that trees which seemed far enough apart may close up their crowns and crush out the coppice in patches.

Variation of cover during a coppice rotation.—In the exploitable coupe the diameter of oak crowns is 13 to 15 times that of the stem, in the exploited coupe it is 10 to 25 times. The annual increase of stem diameter is 6 to 7 millimetres, or about a fourth of an inch. Applying these figures in the exploited coupe where measurements are easy, we may form an idea what the cover will be like by the next felling. For instance, a stem of 0·30 diameter in the exploited coupe will have a crown of 0·30 by 25·3=7·6 *m*. Just before the next felling, the stem will be 0·48, and the crown 0·48 × 13·3=6·4 *m*. An oak of 0·50 in the exploited coupe has a crown of 0·50 × 20·6=10·3. Just before the next felling the stem will be 0·68, and the crown 0·68 by 14·2=9·7 *m*. It appears strange that the crown of the same tree should be less in the exploitable coupe than it was when the coppice was two or three years old, but such is the case, and if we add the cover of a hundred or so young stems per hectare, reserved but not counted in the exploited coupe, which have now acquired a diameter of about 0·25, we reach the curious result that in the exploitable coupe of oak, the cover of the reserves is approximately what it was when the coppice was two or three years old. This is explained by the fact that in the exploitable coupe all the existing standards are measured, whether flourishing or in process of suppression, whilst in the exploited coupe all the latter have been cut out, leaving none but fine trees. For mixed oak and beech, the cover over coppice of two or three years old is about four-fifths of what it will be when the coupe is exploitable. In this case, equality only occurs when the coppice is 5 to 7 years old. From the above it may be deduced that in the course of a coppice rotation the cover of the standards passes through a maximum, the process being somewhat as follows. Previous to the felling, all the standard oaks are crowded by the coppice, under the influence of which the branches are pressed closer to the trunk, some of the trees even becoming suppressed. At the felling the coppice disappears, and with it the suppressed trees. The finer trees only remain, and these are suddenly isolated. The branches, now at liberty, in their search for heat and light, and partly through their unsupported weight, extend themselves more horizontally, the angle of insertion increases and the crown tends to become more globular. The expansion, sudden at first, becomes gradually slower, and for 6, 8, or 10 years, so long as the trees are isolated, the cover increases About the tenth year, the coppice, having grown up, begins to force the branches closer to the trunk, so that, from this time on, the cover diminishes till the end of the rotation By the time the felling arrives, a certain number of the trees, no longer promising as reserves, come under the axe In the case of a conversion, the mixed coppice of beech, hornbeam &c being kept standing to the age of 50, 60, or more years, would tend to suppress all the oaks, so that in order to preserve these as seedbearers, repeated thinnings are necessary

The word ' cover" is capable of two meanings In the present case, it means the area directly below the crown But in a physiological sense this definition no longer fits Other factors, such as the height of the crown the density of the shade it gives, &c enter into the question This fact is rendered sufficiently obvious by a comparison of the undergrowth found below a high crown with thin shade and the absence of any under a low crown with dense shade both being of the same area Two terms are required, one to indicate the area and the other the degree of nocuity The latter would have to take the form of a co-efficient deduced from several elements In Indian foresters have unfortunately little time for experiments but there is a wide field awaiting investigation and the above is an indication of one opening alone out of many.

F GLEADOW.

The Giant Trees of Portugal.*

At a remote period Portugal was covered with an abundant forest vegetation A scanty population cultivated small clearings surrounded by walls to prevent the incursions of wild animals. Luxurious forests spread themselves on all sides of these clearings, protected not only from excessive fellings, but also from grazing, for flocks and herds were rare and could not wander far from the enclosures for fear of wild animals It was by means of fire that the people attacked these impenetrable thickets, the home of numerous wolves, bears and boars These fires however, lit on the outskirts within certain restricted limits, left the great mass of the forest intact and here trees were able to pass through all the phases of their existence without obstacle and to reach in many cases enormous dimensions

The vegetation of the present day is an indication of what it must have been formerly In the North of the country oaks and chestnuts all predominate, in the South appear cork oaks, holm oaks, carob trees and more or less throughout the country, stone pines and cluster pines In sheltered places on deep and fertile soil, where vegetation has been able to develop without hinderance, colossal trees must have been by no means rare

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* Abridged from an article in the Revue des Eaux et Forêts translated from the Portuguese by M Gebhart,

Later on, consequent on the increase of population, it became necessary to clear larger areas for cultivation, and gradually fires devastated those remote spots which were not reached by the axe. The giants of the forest perished, and their descendants have not since often been favoured with the same conditions for attaining such large dimensions. But little was left of the ancient luxuriance; here and there a tree, spared by time and man, remains as an example of past splendour.

In mentioning the most remarkable trees, we commence with the chestnut, whose large dimensions are sometimes reached, but seldom surpassed by other species. It is in the mountains that the largest and best devoloped chestnuts are found. On the Northern slope of the Sierra de Gardunha there is a large forest of chestnuts which extends at several points up to an altitude of 800 metres. The greater number of these chestnuts have had their large branches cut off for the sake of the wood and fruit, and the vigour of the branches interlacing between trees which at first sight appear old and feeble, is truly astonishing. One of the finest chestnuts of this region is situated close to the road from Fundao to Alcongosta at an altitude of 500 metres. Pollarded in 1880, six years later in 1886 it had produced 20 large poles fit for timber. Its trunk was 18 metres in girth at breast height but contained a hollow 3 metres deep, the crown was 20 metres in diameter. At Alçaide in the groves of M. Falçao there is a stump, 18 metres in circumference belonging to an enormous chestnut which must have rivalled that of Alcongosta. In 1886 there were 32 large poles on this stump, and it is said when the old trunk was standing it served as a hiding place for thieves. On the market-place of Trancoso at an altitude of 870 metres, there is a chestnut 23 metres in height and 6.60 metres in girth. The development of this tree is remarkable by reason of the altitude and the cold exposed situation of the spot.

In the Commune of Guarda are found numerous large chestnuts, one of the largest grows in M. Diaz d'Almeida's property; it is 11.30 metres in girth. Although these trees are capable of attaining great heights one finds few of them which have not been mutilated for the production of shoots. Formerly, when the mountains were less cleared, it was not rare to find wild chestnut of a great height, capable of furnishing timber of large dimensions.

The largest chestnuts which the author has found, were 24 metres high. Heights of 22 metres have been recorded amongst the best poles of an excellent coppice 26 years old, which was seen in 1885 in the park of the Foreign Missions College.

Next after the chestnut, the cork oak is one of the species which attains the largest dimensions. It is not uncommon to meet with trees 1½ to 2 metres in diameter, and some are even larger. Between Niza and Povoa de Meadas on a moor with granite soil, not very hilly, is found one of the largest cork oaks known. This tree belongs to M. le Comte de Linhares, and grows without any obstacle to the development of its crown on the estate of Pai Annes. Its dimensions are as follows: heigth 18 metres, girth of trunk 7.20 metres, diameter of crown 32 metres. It has never had the bark removed. At Azeitao, on the estate of La Tour, there is a cork oak measuring 9 metres in girth, 18 metres high and 28 metres diameter of crown. It is the finest specimen the author has seen. In an average seed-bearing year it produces more that 800 litres of acorns. It shows no sign of decay, in spite of its great age of at least 3 centuries. According to M. Bernadino Barros Gomez on this same estate a cork oak was felled in 1876 which had actually 12 metres in girth.

On the Afteira Estate in the parish of Saint Anna do Matto in the Commune of Coruche there is a large oak remarkable for the large quantity of cork it produces. It is 5 metres in girth, branches at 2 metres from the ground and again 3 metres higher up forming finally 45 large branches which all furnish valuable bark. The height is 17 metres and the crown 25 metres in diameter. The tree is perfectly sound and vigorous. In 1879 it gave 1,465 kilogrammes of cork and again the next time in 1889 this amount was even surpassed, being 1,755 kilos. It should be noted that this cork is of first quality and that it was weighed 30 days after removal from the tree. The cork oaks of Portugal are indeed remarkable trees and there are none in any other country which can surpass them either in size, or in tho quality of their products.

The holm oak is also a tree of great size but does not however attain the enormous dimensions of the cork oak. It occupies an extensive area in Portugal but as it is put under an agricultural, rather than a forest treatment chiefly with the view of the production of acorns there are few trees of this species, which have not been more or less mutilated and hampered in their development by the axe of the pruner. However there are in Alemtejo several holm oaks remarkable for their size. One of them is on the Barras estate, parish Villa Nova da Baronia and belongs to M. Moreno d'Evora; its trunk is 3.35 metres round and the crown 19 metres in diameter. In good seed years, it produces more than 1,000 litres of acorns. One may call it young for it is less than a century old, and it is only a few years ago there were persons living who had known it as a small tree. It is known as 'the beautiful oak' owing to its graceful form and the beauty of its crown. Another interesting oak is situated on the road from Ventas Novas to Elvas in the Commune of Elva. It is said to be 150 years old according to the testimony of the oldest inhabitants of the country. Its trunk is 3.60 m. in girth and its annual production of acorns is 1,000 litres, but reaches 2,000 litres in exceptional years. It is pruned every 8 or 9 years.

There are many colossal oaks too in the North and centre of Portugal. In the forest of Cazal dos Prado, formerly public property, there is a fine crop of oaks (*Quercus lusitanica*) among which there is one tree in full vigor towering above the rest of the crop. Its trunk is 5 40 m in girth and its crown 26 m in diameter. Its annual production in acorns reaches frequently 840 litres. On the Square of the Church of Figueiro dos Vinhos some years ago there were several ancient oaks much mutilated and decayed, the trunk of one of these was 7 80 m in girth. It was a *Quercus pedunculata*

In the Sierra de Minho and the Sierra de Gerez there are still some fine trees to be found In the latter at Leonte, for instance at an altitude of over 800 metres there are specimens of *Q. pedunculata* from 2 to 3 metres in diameter, a remarkable development for such an altitude where the rigor of the climate would seem to render the attainment of such dimensions impossible

There are also several fine, large and vigorous specimens of maples, arbutus, yews and pear trees in the Sierra de Gerez.

Among the conifers are found numerous trees of large size In a memoir on the Pine Forest of Léiria written in 1843 by two naval officers, two pines are mentioned, one of which measured 4 48 m in girth and 97 m in height, the other 4 18 m in girth and 85 metres in height In the same forest in the Canton of Alvenha two very fine pines were measured in 1886, one was 3 metres in girth and 40 metres high, with a clean bole of 27 metres, the other one not so straight, measured 4 20 m in girth and 38 metres in height The forest of Léiria is a State forest of cluster pines which is well worth a visit if one wishes to see this pine under the most favourable conditions, the trees having straight cylindrical stems with their lower branches 20 metres from the ground In no other part of the country can such tall and perfect pines be found, for it is only in the Forest of Leira that all the conditions most favourable for their growth are to be met with, *viz*, the neighbourhood of the sea, a temperate climate, and a sandy soil, deep and fertile, covered with a leafy undergrowth, which preserves its moisture and adds to its fertility However, in that part of the forest which is nearest the sea, it is noticeable that the pines, the nearer they are to the borders of the forest, are proportionately more stunted, under the influence of the north winds which blow so constantly, and with such force, as to prevent the proper development of the tree

The stone-pine, although not attaining the same height as the last, presents numerous examples of large girth and crown development At the Murteira farm belonging to the Lagunes Co, there is a pine 1 60 m in girth and 21 metres high, but its crown, which is 27 metres in diameter, is not complete Its principal branch is missing, and remains of it can be seen where it was cut off by French soldiers at the last invasion. At the Curto farm, there is the most remarkable stone pine in the kingdom. This enormous tree is 6 40 m in girth and more than 40 metres high, the crown is regular, well developed, and it is only branched at a great height from the ground

On a section of a pine trunk 4 77 m in girth, blown down in a tempest 8 years ago the author counted about 300 annual rings, but they were difficult to count, owing to the extreme fineness of the outer rings

The celebrated cedars of Bussaco should also be reckoned amongst the finest and most majestic trees of Portugal, and one cannot but admire their straight column-like stems, the three cedars near the Chapel of St Jose are among the largest and seem to have been the first introduced into Portugal Their height is from 25 to 30 metres, and their girths are 2 40 m, 3 30 m and 4 74 m. The cedars of the Chapel of Bispo and of Fonte Fria, are even larger than these measuring 4 63 m and 4 47 m in girth

In the market place of Trancoso grows the largest ash of Portugal, its girth is 6 6 m and it is 30 metres high The situation where this ash is found is, as has already been mentioned, cold and exposed, being at an altitude of 870 metres

Plane trees also flourish in Portugal, and might be grown to a greater extent, especially in plantations and along roads As an example a tree planted in 1838 is already 3 metres in circumference and 30 metres high, with a crown 24 metres in diameter Another plane tree in the Place de Thomar is 6 metres in girth at the base Considering its age, which is 106 to 108 years, it must have grown very rapidly, for its circumference has increased by 1 5 m in the last 15 years

The eucalyptus trees recently introduced in the country are without doubt destined to become enormous trees, for one already meets with specimens barely 20 years old, more than 30 metres high and 3 metres in girth In course of time these trees will doubtless surpass in dimensions the best specimens of the indigenous species.

II-CORRESPONDENCE

What constitutes a Thinning ?

I see from his recent paper on thinnings, that Mr. Fernandez has returned in a vigorous frame of mind from his furlough, much of which was very usefully spent in an extensive tour through European forests. At the same time he deals very roughly with Mr Symthies, in supposing for a moment that the latter would *willingly* ignore the investigations of European foresters as regards thinnings.

These investigations are very ably summed up by Dr Schwappach, Professor of Forestry at Eberswald, in a recent paper contained in the Transactions of the Royal Scottish Arboricultural Society for 1896, a *résumé* of which I propose to give below.

Schwappach premises that the proper object of economic forestry is the production of the maximum mass of high-priced timber, and that in thinnings made with this object it is essential that the soil should not be exposed to the sun's rays, nor to the beating of the rain, both of which actions impoverish it and reduce the productivity of the forest We must, therefore, encourage the most vigorous individuals in a wood but should at the same time remember that the less vigorous stems left behind in the struggle for existence fulfil a useful function by shading the lower portions of the larger trees by assisting in the removal of the dead lower branches of the latter against which they rub, and by shading the ground

The forester has therefore, to decide on the limits of the density of a wood, which, while securing the above advantages, do not prejudice the development of the more vigorous trees Hence thinnings are necessary and are classed as *weak*, *moderate* or *strong*, according as (*a*) the dead and dying stems only are removed, (*b*) those also which are overgrown by their neighbours or (*c*), those also the crowns of which are considerably curtailed Finally, a thinning may be effected among the trees with vigorous crown (*Licht fullung*, or *eclaircie par le haut*) and this has been chiefly advocated in France, being effected by isolating the crowns of the best trees in a wood about 30 years old and leaving below them most of the dominated stems, which can be kept alive until the next thinning

Schwappach states that the results of recent research on the effects of thinnings are as follows —

Apart from Scotch pine and beechwoods, the effects of weak, moderate or strong thinnings are seen in the production of almost exactly the same quantity of timber, in either case Hence it is better to make moderate thinnings in young woods, so as to give the best chance of future development to the stems which will ultimately furnish high-class timber and later on, to make strong thinnings, so that the timber produced may be concentrated on the selected best trees and that other second class material may be utilized early and swell the revenue

Investigations for beechwoods in Denmark, which are paralleled by those quoted by Mr Fernandez for France, show that strong thinnings, if begun cautiously at an early age, result in an increased volume of timber Scotch pine woods on the other hand, even when left alone, become naturally so thin, that the individual trees develop large crowns, moderate thinnings, therefore, result in the production of the largest mass of timber.

As regards the French method of thinning, *par le haut*, Schwappach states that in Scotch pine woods, the more vigorous trees, if isolated cannot make much use of their opportunities, whilst the establishment of an underwood to protect the soil is necessary Even in beechwoods this method of thinning reduces the production. Broillard advocates this method for silver-fir woods and his great experience with forests of this species carries much weight, but clearly results from experimental plots can alone decide the question

All the foregoing remarks apply to one-aged, pure woods, but Schwappach says nothing about mixtures of beech and oak or other mixtures of shade-bearing and light-demanding trees, it is then obviously necessary from the first to keep the crowns of the light-demanders above the surrounding shade-bearers, to cut out all dominated light-demanders, and to preserve a sufficient number of dominated shade bearers to afford the necessary protection for the soil which the light cover of the oaks and other light-demanders does not afford Will not some one supply the *Indian Forester* with result of thinnings in some sample areas of sal and other Indian trees ?

W R. FISHER.

The Dimensions of Trees.

With reference to your note on the above, I believe much larger teak grows in Southern India than in Burma I have measured two or three trees over 22 girth in the Malabar forests A tree, if I remember right, over 26 in girth used to grow nearly opposite the Elephant lines at Mt Stuart in the Anamalais. Huge trees grow in the inaccessible Periar Valley about 10 miles south of Mt Stuart I unfortunately have not got exact notes of measurements I took, but I have no doubt the present Divisional officers of Coimbatore and Malabar can confirm my statements

J G F M.

III -OFFICIAL PAPERS & INTELLIGENCE

Circular Resolution No. $\frac{17}{56}$P.

Of the Government of India in the Department of Revenue and Agriculture (Forests), dated Simla, the 4th November 1896

In paragraph 5 of Circular Resolution No. 18-F, dated 29th July 1891, it was remarked as follows —

"There will at present be 193 officers on the Upper Controlling Staff (exclusive of officers on foreign service), and 80 officers on the Lower Controlling Staff The Upper Controlling Staff will be divided into an Imperial and a Provincial Branch At the outset the Upper Controlling Staff will comprise only officers of the Imperial Branch, but, as opportunities occur, they will be replaced by officers of the Provincial Branch up to a limit of 40 appointments."

Since the above was written, 17 appointments have been added to the Upper Controlling Staff in Burma, of which three are ultimately to be transferred to the Provincial Service. Thus the 193 appointments have become 210 and the 40 appointments 43. Of these latter, the appointments mentioned in the margin have already been transferred from the Imperial to the Provincial Service. But it will be convenient to deal with the transfer as a whole, to start from the basis of the Imperial and Provincial Services as constituted before any transfer had taken place, to detail the 43 appointments which are to be transferred and their distribution, and to lay down the manner in which their transfer will be gradually effected.

Burma	6
Central Provinces—Berar ..	8
Punjab	1
Bombay	1
North Western Provinces and Oudh .	1

2. The appended tables show the Forest services of each province or group of provinces as constituted before the transfer is begun (Table B) and after the transfer is complete (Table C).

It will be noticed that the total strength will eventually be reduced in the Punjab, and increased in Madras, by the transfer of two Assistant Conservatorships from the former to the latter province. This change is intended to reduce in some degree the inequalities which will still exist in the proportions between Deputy and Assistant Conservators in the Imperial Service of the several provinces as finally constituted. Working with such small numbers, it is impossible at present wholly to remove such inequalities. The Government of India, however, fully recognise their existence, but their effect will not become apparent for some considerable time; and meanwhile, advantage will be taken of any increase or rearrangement of the Forest Staff that may become necessary, in order to reduce or remove them. The Governor General in Council will be glad if Local Governments will bear this point in mind.

Each Provincial service will, when the transfer is complete, be independent of the Imperial service in the province concerned, and will (except in one point, presently to be noticed, connected with the Bengal, Assam and North-Western Provinces services) be self-sufficing and self-contained. For every new post added to the Provincial service, an appointment of corresponding class and grade in the Imperial service must simultaneously be abolished, *viz.*, an Assistant Conservatorship, 2nd grade, for an Extra-Assistant Conservatorship, 2nd grade, a Deputy Conservatorship, 4th grade, for an Extra Deputy Conservatorship, 4th grade, and so on.

3. The appended Table D shows the grading and distribution of the appointments that are to be transferred. The transfer will ordinarily be made as follows :—The annual recruitment from

England has been cut down so as to suit the reduced Imperial cadre, and so adjusted that each year the number of recruits who will arrive from England will be fewer by two than the number which would be required to maintain the cadre at its present strength There will thus be, for the present, two appointments in the 2nd grade of Assistant Conservators annually available for transfer, and they will be transferred accordingly by the Government of India to one or other of the Provincial lists as Extra-Assistant Conservatorships of the 2nd grade

4 The initial appointments thus transferred to each Provincial service in the second grade of Extra Assistant Conservators may be regarded as pilot appointments, and their rise on the Imperial list will govern the subsequent transfer of appointments to the higher grades of that service Each such *appointment* will continue for the present to be shown in the Imperial list in its proper place and with its proper number the words "transferred to the Provincial service being entered in italics, and not the name of the officers holding the transferred appointment which will be shown on the separate Provincial list to which he belongs The pilot appointments will rise on the Imperial list in ordinary course, and whenever any pilot appointment reaches in the course of the permanently substantive promotion * a grade from which a transfer is to be made an appointment in that grade will be reduced in the Imperial list and a corresponding appointment added to the Provincial list Thus each pilot appointment will transfer one appointment from the Imperial to the Provincial service from each grade which it enters in the course of its rise on the Imperial list, so that as many pilot appointments (and no more) must be allowed to rise to each grade as there are transfers to be made from that grade As soon therefore, as all the transfers which are to be regulated by the rise of any particular pilot appointment are complete, that pilot appointment being no longer required, will be struck off the Imperial list When the appointments to be transferred in any province, as shown in Table D, do not include any in the lowest grades the transfers made as above in those grades will be temporary only for the purposes of the process of transfers, and as that process progresses, these temporary appointments will be retransferred to the Imperial list, so that the total number of transfers to be made to the Provincial list shall never be

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* When a pilot appointment occupies such a position on the Imperial list that if the appointment were still borne on that list its incumbent would in ordinary course be entitled to officiating sub *pro tem* or provisionally substantive promotion such promotion will be given to the officer who stands next below the pilot appointment on the Imperial list In the last two cases the pilot appointment and that officer's name will be shown bracketed together in the grade to which temporary promotion has been given and when the promotion becomes permanently substantive the officer will revert to the grade below, the pilot appointment alone being retained in the higher grade, from which a transfer will then be made.

exceeded Wherever, as noted above in paragraph 1, an appointment has already been transferred direct from a higher grade than the lowest, the corresponding Imperial appointment will be retained for the present in the Imperial list as a pilot appointment As soon as the transfer of appointments to the Provincial cadre is complete in any province, the Provincial service of that province will be self-contained and independent and will cease to have any connection with the Imperial list Table A shows in detail how the process of transfer would be worked in an imaginary province

5 It must be clearly understood that the rise of the pilot appointments on the Imperial list regulates the *transfer of appointments only*, and has nothing whatever to do with the *promotion of individual officers* on the Provincial list Each new appointment as it is added to that list, becomes merged in it, and the fact that it has been added by transfer in no way distinguishes it from the other appointments already on the list It is in each case for the Local Government to decide with reference to the considerations set forth in the next following paragraph which of their Provincial officers is to be promoted to the new appointment, and the fact that the appointment which an officer holds happens to have been added to the list by transfer gives him no sort of claim to the next higher appointment which may be transferred as the pilot appointment rises So again the fact that a pilot appointment reaches a point on the Imperial list at which its incumbent, if it was still borne on that list, would receive officiating or *sub pro tem* or provisional substantive promotion creates no claim to such promotion on the Provincial list The promotion on that list is entirely independent of the Imperial list, no appointment can be held by any Provincial officer till it has been actually transferred to the Provincial list, and as already explained the transfers will be regulated by the *permanently substantive* position of the pilot appointments *

6 Promotions from Extra-Assistant Conservator to Extra-Deputy Conservator will mainly depend on the qualifications of officers and the practical efficiency shown by them in the discharge of their duties, and though the position attained by seniority on the list of Extra-Assistant Conservators will be taken into consideration such promotion cannot be given or claimed on grounds of seniority alone, and Local Governments may promote a meritorious officer of a lower grade to an Extra Deputy Conservatorship which may have become vacant Appointments to and promotion in the grades of Extra-Deputy Conservators will also in all cases be dependent on fitness, and in any case when a competent Provincial officer is not forthcoming for a vacancy in those grades, an Imperial officer may be appointed to hold it temporarily on the pay of the corresponding Imperial grade, until a fit officer is available on the Provincial list But, subject to this condition, all

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* See note on previous page

vacancies on the Provincial list will be filled up from that list, the promotion in it being entirely independent of the Imperial list. So long as an appointment on the Provincial list is temporarily held, under the circumstances explained above, by an Imperial officer, a temporary transfer to the Provincial list may be made in any lower grade for which there is a fit Provincial officer available. It will be noticed that a part of the improved prospects which the reorganisation was to afford to the Provincial service has already been enjoyed by that service for some years past, the pay of certain Extra-Assistant Conservatorships having been raised to Rs 300 and Rs 350 per mensem The Extra-Assistant Conservatorships, which will now be transferred in the first instance, will be of the Rs. 300 grade as already explained, but the existing Extra-Assistant Conservatorships in the Rs 350 grade will of course rank as senior to them

7 With reference to the exception mentioned in paragraph 2 of this Resolution, it must be explained that although a certain number of Extra-Deputy Conservators have been allotted to the Lower Provinces of Bengal, to Assam, and to the North-Western Provinces and Oudh respectively, yet it is impossible to arrange that every grade of that class should be represented in each of the three Provincial services It is, therefore, necessary for the present to unite these services for the purpose of promotion in the grades of Extra Deputy Conservator

One Extra-Deputy Conservator of the 3rd and one of the 4th grade have therefore been allotted to Bengal and Assam jointly, and one of the 2nd and one of the 1st grade to the three services jointly. Of these four appointments of the Extra-Deputy Conservator, one will be held in Assam, two in Bengal, and one in the North-Western Provinces ; but promotions from grade to grade will, so long as the strength of the grades remains unchanged, be common to the services that are combined in each case, and will, *cæteris paribus*, fall to the senior officer

8 Finally, it must be understood that the eight allowances of Rs 50 per mensem to Extra-Assistant Conservators holding charge of Forest Divisions, of which two are held in the Bombay, two in the Madras, and four in the Bengal Presidency, under the terms of this Department's Circular Resolution No. 18-F. of 29th July 1891, are not affected by the present orders.

Table A.—Illustrating the process of transfer of appointments from the Imperial to the Provincial Service.

Class	Grade	INITIAL CONSTITUTION 1895		1896		1899		1900		1903		1905.		1906		1909		1911		1913.		FINAL CONSTITUTION 1914.	
		Imperial.	Provincial	Imperial	Provincial	Imperial	Provincial	Imperial	Provincial	Imperial.	Provincial.	Imperial.	Provincial.	Imperial.	Provincial.	Imperial.	Provincial.	Imperial	Provincial	Imperial.	Provincial.	Imperial	Provincial.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DEPUTY AND EXTRA DEPUTY CONSERVATORS.	Grade II	3 A B C		3 B C D		3 F G H		3 G H I		3 J K L		3 K L M		3 L M N		3 N O P		3 P Q R		3 T U Pilot I	1 I — —	2 T U —	1 I — —
	Grade III	4 D E F G		4 E F G H		4 I J K L		4 J K L M		4 M N O P		4 N O P Q		4 O P Q R		4 Q R S T		3 S T U Pilot I	1 I	3 V W X	1 II — —	3 V W X —	1 II — — —
	Grade IV	6 H I J K L M		6 I J K L M N		6 M N O P Q R		6 N O P Q R S		5 Q R S T U Pilot 1	I I	5 R S T U Pilot 1 V	1 I	5 S T U Pilot I V W	1 I	4 U Pilot I V W X Pilot 2	2 I II	4 V W X Y	2 II III	4 Y Z AA BB	2 III IV — — — —	4 Y Z AA BB — —	2 III IV — — — —
ASSISTANT AND EXTRA ASSISTANT CONSERVATORS	Grade I	4 N O P Q	1 I	4 O P Q R	1 I	3 S T U Pilot 1	2 I II	3 T U Pilot 1 V	2 I II	3 V W X	2 II III	2 W X Pilot 2	3 II III IV	2 X Pilot 2 Y	3 II III IV	2 Y Z	3 III IV V	1 Z Pilot 3	4 IV V VI VII	1 CC	4 V VI VII VIII	1 CC — — —	4 V VI VII VIII
	Grade II.	4 R S T U	2 II III	3 S T U Pilot 1	3 II III IV	3 V W X	3 III IV V	2 W X Pilot 2	4 III IV V VI	2 Pilot 2 Y Z	4 IV V VI VII	2 Y Z	4 V VI VII VIII	1 Z Pilot 3	5 V VI VII VIII IX	1 Pilot 3 AA	5 VI VII VIII IX X	3 AA BB CC	3 VIII IX X	4 DD EE FF GG	2 IX X — — —	4 DD EE FF GG	2 IX X — —
Total Numbers		21	3	20	4	19	5	18	6	17	7	16	8	15	9	14	10	14	10	14	10	14	10
		24		24		24		24		24		24		24		24		24		24		24	

Explanation of Table A.—Columns 3 and 4 show the Forest Service of an imaginary Province as it stands at present, omitting all above Deputy Conservator II grade and below Extra Assistant Conservator II grade, the numbers of the Imperial Service being represented by letters of the alphabet, and those of the Provincial Service by Roman numerals.

It is proposed to transfer 7 appointments from Imperial to Provincial, i.e., one Deputy Conservatorship of the II, one of the III and two of the IV grade and three Assistant Conservatorships of the I grade.

When the transfer is complete the service will stand as in columns 23 and 24.

It is assumed throughout for the sake of simplicity that all the promotion is by seniority, that all the steps in the Imperial Service are by retirement from the top of the list, that no vacancies occur by retirement, death or transfer in the Provincial Service, and that there are no supernumerary appointments in the II grade of Assistant Conservators. None of these assumptions affect the principles which the table illustrates.

In 1896 a vacancy occurs, and the first initial transfer is made in the lowest grade.

By 1899 there have been four steps, and the first pilot appointment reaches the I grade of Assistant Conservators, in which grade an appointment is accordingly transferred.

In 1900 another vacancy is absorbed at the bottom of the list by a second initial transfer.

By 1903 three more steps have been gained and the first pilot appointment reaches the IV grade of Deputy Conservators, in which therefore an appointment is transferred. The three steps should have taken the second pilot appointment into the I grade of Assistant Conservators. But that would have involved the transfer of one of the three Imperial appointments in that grade, and as there are already three Imperial officers above the pilot appointment in the grade, the pilot appointment must wait.

In 1905 the second pilot appointment reaches the I grade of Assistant Conservators and another transfer is made in that grade.

In 1906 a third vacancy is absorbed at the bottom of the list by a third initial transfer. Since the greatest number of appointments to be transferred in any grade is three, the three pilot appointments now existing are sufficient and no further initial transfers will be made at the bottom of the list.

By 1909 there have been two more steps, the second pilot appointment reaches grade IV of Deputy Conservators and a second transfer is made in that grade. The transfers in that grade being now complete and only one transfer being required in each of the higher grades, which will be effected by the rise of the first pilot appointment, the second pilot appointment has now done its work and will not appear again. The two steps should have taken the third pilot appointment into the I grade of Assistant Conservators. But that would have involved the transfer of one of the two Imperial appointments in that grade, and as there are already two Imperial officers above the pilot appointment in the grade, the pilot appointment must wait as in 1903.

By 1911 two more steps take the first pilot appointment into grade III of Deputy Conservators and the third into grade I of Assistant Conservators, and a transfer is accordingly made in each grade. The third pilot appointment has now done its work and will not be shown again. As in the case of the pilot appointments in 1903 and 1909 explained above, AA has to wait for the next step. The total number of Provincial appointments sanctioned in and above the II grade of Extra Assistant Conservators being ten, which were all filled in 1909, two of the Extra Assistant Conservatorships II grade which had been temporarily created for the purposes of the transfer paragraph 4 of the Resolution are now absorbed by corresponding appointments being made in the Imperial Service.

By 1913 four more steps have been gained and the first pilot appointment reaches the II grade of Deputy Conservators. A transfer is made in that grade, the last of the temporary Extra-Assistant Conservatorships II grade is retransferred to Imperial and the process of transfer is complete.

The last pilot appointment is now removed from the list and the services are separately and independently constituted as shown in columns 23 and 24.

The numbers of appointments and transfers have been designedly arranged in this example so as to illustrate all the possible difficulties and make the process as complicated as possible. In actual practice the process will ordinarily be far simpler.

Table B.—Constitution before commencement of transfer

Province.	Imperial Service				Provincial Service			Total strength
	Conservators.	Deputy Conservators	Assistant Conservators	Total strength	Extra Deputy Conservators	Extra Assistant Conservators	Total strength	
1. Bengal with Andamans (for Imperial Service)	1	9	5	15		7	7	22
2. Assam	1	6	3	10	--	3	3	13
3. North Western Provinces and Oudh (with Ajmere)	3	9	7	19		8	8	27
4. Punjab (with Baluchistan), Central Provinces, Berar and Coorg	4	22	16	42		22	22	64
5. Burma with Andamans (for Provincial Service)	4	36	14	54		20	20	74
~~6. Madras~~	3	21	10	34		11	11	45
7. Bombay ..	3	19	9	31	..	19	19	50
Total	19	122	64	205		90	90	295
For Imperial List ..				5		1	1	6
For Foreign Service ..				3				3
Grand Total ..		..	..	213	..	91	91	304

Table C—Constitution after completion of transfer

Province	IMPERIAL SERVICE.				PROVINCIAL SERVICE			Total strength.
	Conservators	Deputy Conservators.	Assistant Conservators	Total strength	Extra Deputy Conservators	Extra Assistant Conservators	Total strength	
1. Bengal, with Andamans (for Imperial Service)	1	7	4	12	2	8	10	22
2. Assam	1	5	3	9	1	3	4	13
3. North Western Provinces and Oudh (with Ajmere	3	6	6	15	3	9	12	27
4. Punjab (with Baluchistan), Central Provinces, Berar and Coorg.	4	14	14	32	8	22	30	62
5. Burma with Andamans (for Provincial Service)	4	27	12	43	9	22	31	74
6. Madras	3	15	8	26	6	15	21	47
7. Bombay ..	3	15	7	25	4	21	25	50
Total ..	19	89	54	162	33	100	133	295
For Imperial List ..	..			5		1	1	6
For Foreign Service ..	..			3				3
GRAND TOTAL	...			170	33	101	134	304

Table D —Appointments to be transferred.

	Province	EXTRA DEPUTY CONSERVATORS					EXTRA ASSISTANT CONSERVATORS			GRAND TOTAL
		1st grade, Rs 600	2nd grade, Rs 550	3rd grade, Rs 500	4th grade, Rs 450	Total	1st grade, Rs 350	2nd grade, Rs 300	Total	
1	Bengal	1	1	1	1	2	1		1	4
2	Assam					1				
3	North Western Provinces and Oudh (with Ajmere)			1	1	3	1		1	4
4	Punjab (with Baluchistan) Central Provinces Berar and Coorg	1	2	2	3	8				8
5	Burma with Andamans (for Provincial Service	1	2	2	4	9	1	1	2	11
6	Madras	1	1	2	2	6	2	2	4	10
7	Bombay	1	1	1	1	4	1	1	2	6
	TOTAL	5	7	9	12	33	6	4	10	48

IV.—REVIEWS

Schlich's Manual of Forestry, Vol V. 'Utilization' by W. R. Fisher.

Last year we reviewed Mr Fisher's admirable work, or rather translation, on Forest Protection, and we are now called upon to do the same for the bulky but most valuable and interesting work before us, on 'Forest Utilization' In a country like India, where Forest officers have to deal with huge forest areas, circumstances generally prevent too elaborate and detailed systems of forestry being adopted, and the demand, in the case of timber, chiefly falls upon a few special kinds, so that 'Utilization becomes almost of more importance than sylviculture and the energies of the staff have at the outset to be directed more to the supply of the country, the development of the trade and the best means of bringing to notice the various forest products of value, than to detailed measures for reproduction It is not therefore to be wondered at, that in India we have hitherto been obliged by circumstances to pay much attention to the subject of 'Utilization' and that the systems adopted for the extraction of forest products will bear comparison with those in force in any other part of the world The arrangements for the cutting, logging, conversion and extraction of timber from the teak forests of Burma and from the deodar forests of the

North-West Himalaya have given the greatest credit to Indian Forest officers, while their work in the supply and development of the trade in such produce as sandalwood redwood india-rubber myrabolams rope-grasses turpentine and resin, tanning barks and dyes, has been of the greatest importance, an importance the more worthy of note, perhaps, as the work has been so quietly and modestly done There is, no doubt, still an enormously wide field in the Indian forests for development of trade and the more complete utilization of resources, and to help us in working to this end such books as that which Mr Fisher has now given us will be of the greatest assistance. We have already in India a manual on the subject, embodying the course taught at the Forest School of Dehra Dun, namely 'The Utilization of Forests' by Mr E E Fernandez, an excellent work, but one which, of course, being applicable only to India, is, as Mr Fisher says (p vi) "less comprehensive" than the volume now under review

It must not be supposed that Mr Fisher claims for his book an originality to which it really is not entitled, for, as the title page tells us it is 'an English translation of ' Die Forstbenutzung" by Dr Karl Gayer Privy Councillor of Bavaria and Professor of Forestry at the University of Munich' To some of us, ' Gayer's Forstbenutzung' has long been a regular companion but to those who know little or no German, and to those who well as they may understand German yet prefer to read English, Mr Fisher's work will be most acceptable and especially as additions of importance have been made from the 'Technologie Forestiere' of M L Boppe of the French National Forest School at Nancy, and notes of great value have been given from time to time from the Indian experiences of the translator and his friends in our Indian service It is only right for us to mention, further, that the work has necessitated the laying out of a considerable amount of money, so that it may be hoped that Indian Forest officers will support and assist Mr Fisher and Dr Schlich by helping them to dispose of their stock on hand

The Introduction to Mr Fisher's work thus defines 'Forest Utilization — "a systematic arrangement of the most appropriate 'methods of harvesting converting and profitably disposing of 'forest produce, in accordance with the result of experience and 'study", and the work itself is divided under three heads or Parts, viz

I Harvesting, conversion and disposal of forest produce,
II Harvesting and disposal of minor forest produce,
III Auxiliary industries despending on forestry.

In Part I the first subject discussed is that of the 'Technical properties and qualities of wood' (Chapter I) We are told how wood consists of three kinds of elementary organs, viz 'wood cells,' 'wood vessels' and 'wood fibres,' which do not, however, all occur always at once in the same species, and how, in addition, may also be found 'resin cells' and 'medullary rays,' the relative values of woods depending largely on the arrangement and distribution of these organs. Under this subject comes a discussion on the classification of timbers according to the relative amount of heartwood and sapwood given by the tree ; and here Mr. Fisher brings out his own classification of timbers into—

(*a*) Heartwood trees, *i. e.*, trees which possess a true heartwood.
  (i) Broad zones of sapwood—oak, elm, walnut, Scot's pine, etc.
  (ii) Narrow zones of sapwood—sweet-chestnut, mulberry, larch, etc.
(*b*) Trees with incomplete heartwood, *i. e.* where there is no distinction in colour, but where the heartwood no longer takes any share in the vital processes—spruce, silver-fir, beech.
(*c*) Sapwood trees, *i e*, trees with no clear distinction between the heartwood and sapwood—ash, hornbeam, maple, alder &c.

This classification is new to us, but we think that in practice it cannot always be easy to distinguish between the woods of the last two classes.

In discussing the 'specific gravity' of woods, Mr. Fisher has given us the admirable plates taken from Mons. Boppe's 'Technologie' which shew the different types of oak and spruce wood according to speed and regularity of growth to illustrate his discussion of relative density. In classifying woods according to specific gravity he adopts the following scale :—

Very heavy woods 0·75 and upwards, *e. g.*, yew, ash, pedunculate oak.
Heavy woods 0·70 to 0·75, *e. g.*, sessile oak, hornbeam, beech.
Moderately heavy woods 0·55 to 0·70, *e g.*, elm, maple, birch, larch.
Light woods 0·55 and less, *e g*, alder, pine, spruce, poplar.

In India we do not usually talk of 'specific gravity,' but of the 'average weight per cubic foot,' so that the classes above referred to would be about : 47 lbs and over, 44 to 47 lbs 34 to 44 lbs and 34lbs. and under In India, of course, most of our chief woods would be 'very heavy,' and indeed we should require a still higher degree of comparison to bring in these woods which are heavier than water and may even run up to 92 lbs. (sp.g. 1·31) in the case of *Hardwickia* and 76 lbs. (sp. g 1·21) in that of *Mesua.*

The question of 'hardness' is then discussed and the fact is pointed out—a fact which was ascertained from Prof. Gayer's own experiments—that some of the softer woods like the lime, willow and poplar shew greater resistance to the saw when freshly felled than the Scot's pine, larch and even the oak. Under the heading of 'pliability' comes the question of the elasticity and flexbility of woods, and then our author proceeds to the discussion of transverse strength, a subject which is rather briefly treated, we suppose because it is supposed to belong more properly to the domain of Forest Engineering.

'Defects and Unsoundness' are fully treated, with excellent illustrations among which fig 11 may be recommended as an excellent picture of the results of the enclosure in the wood of a dry branch and fig 12 as one of the results to be obtained by pruning such branches in good time

Chapter 2 discusses the Industrial uses of Wood' in three subdivisions —(i) timber (ii) firewood and (iii) woods arranged according to their uses Under the first of these comes the description of the various methods of conversion according to the class of material which is required We are shewn how saw-cuts should be made so as produce the largest amount of radial section wood such wood shewing a better silver-grain and standing friction better, how timber may be split for use in palings, casks, etc, what are the characters required for timber used in building and construction, what are the descriptions and the shapes of pieces in use for paving blocks, mine-props, railway sleepers, etc, and then the pieces used in ship-building are enumerated and described In regard to the latter industry, our author explains how wood has come to be so largely replaced by iron of late years in shipbuilding work, but that there is still a very large amount of wood required for smaller vessels and for fresh-water barges We note that he does not mention the very extensive use of teakwood as a backing to the iron-plates of men of-war Under Miscellaneous use' come wheelwright work the building of railway carriages and trucks, cooperage, roof shingles, wood wool now so largely used as a packing material, matches, pencils and musical instruments, while by no means the least of the many industries mentioned is that of wood-pulp, the demand for which bids fair to become enormous in a few years and capable of requiring the careful afforestation of almost every spare acre of otherwise waste land Mr Fisher tells us that in the years 1892-1894 inclusive no less than 200,000 acres of forest were denuded in North America to satisfy the demands of 210 paper factories, and that in 1892 there were in Germany 600 factories consuming 35 000,000 stacked cubic feet of wood in the production of 200 000 tons of wood-pulp, but he adds that there is now an excess of production over demand That such is the case is very probable because of late in Europe the demand for fuel wood has much decreased so that owners are likely to try and recoup themselves by selling their material for paper pulp but as the consumption of paper increases yearly, the demand for paper material must also increase, and it would seem doubtful if, on the whole, existing forest areas will, after a few years, be capable of meeting it. Under 'Firewood' we are given but a very short chapter, chiefly because such subjects as the manufacture of charcoal are treated further on, and then comes a useful table of the chief European and exotic woods arranged according to their uses We should have liked to see the list of exotic woods much extended for there are a large number of kinds known only by trade names, whose identification would be of great interest. A few days ago, for instance, we come across a furniture wood of great beauty, 'partridge wood,' but we have very little notion what it is and where it comes from It is not in Mr Fisher's list, and the information given by Holzappfel is rather meagre,

In Chapter 3 we have a full account of the methods of 'Felling and Conversion of Timber,' beginning with the organization of labour gangs the implements used, the seasons of felling and the methods of felling and first rough conversion The different kinds of axes and saws in use are fully described with appropriate figures, and there are also excellent pictures to explain how best trees can be felled with either of these implements Then comes an account of the chief methods adopted for clearing the felling area sorting the converted material and recording the yield, and here we find the methods dragging, sliding and sledging explained in full

The 4th Chapter treats of 'Land Transport,' and we are glad to see the importance attached to good forest roads as so much more durable and so much more useful for general purposes than slides and sledge roads This chapter is specially illustrated by a photographic picture of the well-known Chamba log slide, and Mr. Fisher has also briefly described the Limbatach plank slide and the Deota wet slide in the Himalayan forests No modern book on the subject would be complete without an account of forest tramways, both railways and wires , and the latter, which we believe to be the cheapest and *the* system of the future, we should have liked to see treated in greater detail

In Chapter 5 comes 'Water Transport,' so largely employed in Germany and here treated at considerable length We are glad to see that the boom on the Jumna at Daghpathar has been briefly described, but think that those which have so long done such excellent work in Burma though perhaps of not so elaborate a construction, might also have been referred to In comparing, in Chapter 6, land with water transport, Mr Fisher comes to the conclusion, a conclusion which we heard ourselves given by the Forest officers in the Austrian Alps, that wherever possible land transport is preferable

Chapters 7 and 8 give an account of Wood Depôt, and their management and of the business involved in the disposal and sale of wood This last chapter will be found interesting by Indian Forest officers who often have to decide whether sale of material standing in the forest or the extraction and sale by departmental agency is the most advantageous in the special circumstances of different localities

Part II, which discusses the 'Harvesting and Diposal of Minor Forest Produce' devotes special chapters to (1) barks , (2) fodder; (3) field crops in combination with forestry ; (4) fruits and seeds, gathered for reproduction works, or allowed to be eaten or removed or collected for industrial use ; (5) dry fallen wood ; (6) stone and other minerals ; (7) litter and (8) resin-tapping, while a ninth chapter treats of other but less important items The chapter on barks treats chiefly, of course, of those used for tanning in Europe and is a very interesting one It begins by a brief description of the process of tanning and the explanation that there are three processes *tanning*, the preparation of leather with substances containing tannin , *tawing* that by means of aluminium salts, used for kids and other white leathers, and *shamoying*, that by means of fats or oils and producing wash leather , besides a fourth more recently discovered process by means of chromates It then enumerates the different materials in common use (by the way it is *Uncaria Gambier* not *U Gambia* that gives the astringent, and it should be *Myrobalams* not *Myrobalans*) and then proceeds to describe in full the harvesting of oak bark spruce bark, birch bark larch bark and willow bark It is the latter that is used in tanning Russian leather, the pleasant scent being given by a soaking in the oil distilled from the external white layer of the birch.

The question of fodder includes that of pasture and the discussion of this subject by Professor Gayer is very interesting We wish we had space for some long quotations for they might be of use in this country, but the main conclusion is that forest pasture, though affording means of utilizing a good deal of produce which is available and occasionally serving to suppress dense growth and allow young trees to obtain light or to wound the soil ’ and allow resting places for seed, has many disadvantages of greater importance In Germany, apparently except in high mountain districts, forest pasture is now largely replaced by stall-feeding We wish this could be the case in India to the great improvement of the quality of the cattle The question of field-crops in combination with forestry is also treated at length, and we learn that a practice akin to our Indian ‘jhuming’ is still carried on in Finland, Northern Sweden, parts of Russia and here and there in the Alps and Carpathians But the chief cases in which a system is resorted to of mixed agriculture and forestry are (1) the *Schmoren* or *Schmoden* system in Germany, in which, after a clear felling, crops are cultivated for two years and the area is then restocked artificially ; (2) the *Hackwald* and *Waldfeldbau* in which crops are grown in oak coppice for about two years when the new forest growth is left to come on

So, too, is the question of Forest litter’ one of considerable importance in Europe, the chief materials removed being · (*a*) dry fallen leaves or needles (*b*) moss and grass, (*c*) forest weeds, such as broom, heather, fern, reeds, &c , and (*d*) branch loppings of coniferous trees The evil effects of the removal of such things are fully explained, and it is recorded that from careful observations made by Dr Bleuel in the Spessart “ by the annual removal ‘ of litter for 23 to 30 years in older beech-woods, the wood-increment fell in different cases by 32, 39, 42 and even 56 per cent. on 'inferior soils, but that on good basalt, in the Rhone Valley, the 'loss was only 8 per cent In Scotch pine-woods of good quality, 'the loss, where the litter was removed annually, was 7 5, 9 3 'and 10 9 per cent."

The chapter on resin-tapping is taken from Boppe's 'Technologie Forestière,' as the procedure is not followed in Germany with pine, and in the last chapter in the book is given an account, taken from our pages, of the industry of resin and turpentine as practised in Gascony These methods are all well known to our readers, but it is not perhaps so well known that in Germany the spruce is tapped and in Austria the larch and black pine. In speaking of the resin-work in Jaunsar in the North-West Himalaya Mr Fisher says, "it is more profitable to sell the crude resin than to distil it," but he forgets that the demand for crude resin is very limited indeed, while that for turpentine is very large, much larger than the chir pine forests available are capable of producing The less important articles of minor produce enumerated in Chapter 9 comprise grass seeds, herbage, wood-wool, vanillin (obtained from the cambium layer of conifers) mosses, 'Knoppern' galls, truffles edible fruits limebast and several other small items are mentioned as of interest

In Part III 'Auxiliary Forest Industries,' an account is given of the 'antiseptic treatment of timber' and the chief methods of injection Then forest saw mills are described and the processes of wood-distillation and the manufacture of charcoal, also the digging and preparation of peat

From our account it will be seen that Mr Fisher's work is one of a very comprehensive character, and is full of subjects of the greatest interest to all who have any concern with the management of forest property in any country We strongly recommend its study to our readers

The volume we have attempted to describe forms the 5th and final one of the Manuals issued from Coopers Hill under Dr Schlich's able supervision As our readers are aware, the *first* volume, which is now in its second edition, treats of the "Introduction to Forestry" and includes the principles of sylviculture, the *second* of which a second edition may soon be expected, of the "Formation and tending of woods or practical sylviculture", the *third* of "Forest management" with the preparation of working plans, the *fourth* of "Forest protection" All these have, as they appeared, been noticed in our pages the first three having been done by Dr Schlich himself, the last two by Mr Fisher. They form a professional series of the greatest value, which should be in the libraries of all English-speaking Forest officers They represent a great amount of hard work and confer much credit on their authors Financially, they have not perhaps been as successful as had been hoped, especially the last three volumes, and it is greatly in the hope of attracting attention to them and furthering their sale that we have in the present review of the 5th Volume, and in our review in our number for January 1896 explained in so much detail their scope and objects We congratulate Dr Schlich and Mr Fisher on the completion of this great work, and hope that the financial success of the series will soon be as great as is their practical value

The Rubber Forests of the Hukong Valley.

The report of Mr H N Thompson, Assistant Conservator of Forests on the Hukong Valley and Upper Namkong basin, contains much interesting information on the fauna and flora of that region It will be remembered that a survey party left Mogaung early last year to meet the party under Mr Way from Assam engaged in surveying the Hukong Valley in connection with a railway from Burma to Assam Mr Thompson accompanied the Burma party and explored the forests between Mogaung and Ningbyen, the meeting place of the two parties and the country around Ningbyen Mr Thompson has compiled a mass of useful information on the forests in general and in particular on the occurrence of trees which would yield timber suitable for railway sleepers and concerning the rubber trade With that section of his report which treats of indiarubber we shall briefly deal As Mr O'Bryen pointed out in his report a few years ago on the rubber forests of Upper Burma the tree in the Hukong Valley is not a gregarious one Mr Thompson tells us that it appears scattered generally through the dense evergreen forests but nowhere does it reach the density per acre of an average teak forest ' Occasionally, a family group of four or five trees may be met with , these are very rare, indeed and the usual thing is to come across a mature tree every 200 or 300 yards in the richer forests' At the headwaters of the Namkong Chaung the average was not quite one large tree to every two acres When the tree is surrounded by dense shade, to get to the light it grows to enormous heights and some of those seen by Mr Thompson were the largest trees of any species he had ever seen So exacting is its demand for light that no seedlings were in the soil, but were invariably growing at a great height from the ground on other trees A few illustrations show the young seedling growing ' up the stem of its host, encircling the latter with its aerial roots and sending them downwards towards the ground till they form great supports on which the main trunk of the fig stands , meanwhile the host is gradually killed off and eventually disappears altogether and the rubber tree is left standing on five or six or even more thick aerial roots " The *ficus elastica* appears to be able to accommodate itself to many varieties of soil and apparently grows best at a considerable altitude Thus, Mr Thompson records, it grows in abundance on Loimaw hill at an altitude of 5 000 feet, and is reported in various other high altitudes in that region The Kachins say it does not grow where there is snowfall, but this seems doubtful

The tract north of the Tanaikha is still the richest in the valley but the difficulties of transport are increasing as the more accessible trees have been worked out Here a Chinaman Law Lawkha has a practical monopoly of the market. On the spot the price of rubber is two rupees per viss * A few years ago a trade route was started across the mountains to Myitkyina but the trader who opened it was murdered probably Mr Thompson thinks, at Law Lawkha's instigation, and the blackmail levied by the Sana Kachins has killed the trade on that route Some of the rubber around the southern basin of the Tanaikha is supposed to be taken down the Chindwin to Kindat but this seems doubtful The natural and shortest route is down the Nampyu to Ra and Palawbum and thence by mules to either Laban or Lingring and so by boats and mules to Kamaing and Mogaung With regard to the output of this tract *i e* from the forests lying at the sources of the Nampyu to the west of Maingkhwan, Mr Thompson says it is very difficult to estimate it 'No reliable information can be obtained from either the Singphos or the Chinese traders employed in buying it as both parties are interested in keeping the real state of affairs dark Of course the usual cry is that the forest is getting worked out that they have now to search for indiarubber at great distances from the lines of export, and that consequently the duty levied by us ought to be reduced The fact, however, still remains that the local Sawbwas have in no way whatever reduced the tax levied by them on rubber collected in their districts or passing through to other places I questioned four of the most influential Chinamen living at Laban, and who are agents of the large Bhamo and Mandalay firms, as to the out turn from this portion of the valley during the present season, but their statements were so very conflicting and contradictory that no reliance whatever could be placed in them and under such circumstances it would be misleading to give any figures As a single instance of the contradictory statements given by the Kachins, I may say that they informed me repeatedly that the yield of a large unworked indiarubber tree in one season does not exceed ten viss—a very different figure from that usually given, and which of course is too low, as I have personally seen about double that quantity extracted from a large tree " The rubber forests at the headwaters of the Namkong Chaung are rich in rubber The tree grows in abundance along the banks of the smaller streams and is also frequently met with on the higher slopes of the hills On these hills Mr. Thompson found the *ficus elastica* attaining as great a height as 200 feet and a girth round the outside of the aerial roots of 100 to 130 feet.

The only forest produce collected in the tracts examined by Mr. Thompson appears to be rubber, and the Kachins from far and near come in to collect it in the dry season. "During my visit to the Upper Namkong and Namsong basins, I twice came across 'octrois' built on the edge of the streams by Singphos from Palawbum and the Amber mines. Toll on all rubber brought down these streams from their headwaters was collected at these stations and none was allowed to pass unless this tax was paid. It was usually taken in kind and amounted to much as ten per cent, the collectors having to pay ten viss for for every hundred collected by them. The Singphos from the, Hukong Valley must have known that they were poaching in these forests, as they decamped as soon as they heard of my arrival." One local viss, it seems, is equal to one and a half standard viss, so the Chinamen must make a very good thing out of it. The Chinamen of the district are all engaged in the rubber-trade. "Great quantities of rice, silk, pasos, gaungbaungs, &c., and stores, are kept by them and sold to the Kachins (at ruinous rates) who pay the price of the goods in indiarubber." *

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* A viss = 3·65 lbs

Mr. Thompson tells us that most of the indiarubber from one of the tracts, reported on by him, that is the whole drainage area of the Taron river above its junction with the Gedu affluent, is exported to Assam across the passes on the Patkoi. Much valuable information on this branch of the subject was collected by Captain Swayne, one of Mr. Way's party, and embodied by Mr. Thompson in his present report. The Nagas reap their crops in December and then set off for the rubber forests. Mr. Way's party met small bands of them on their way to the forests. Every tree in the basins of the Loglai and Taron is known and their positions are pointed out from father to son. It may be taken as correct that the rubber collected in the forests north of the Gedu confluence goes to Assam while that collected in the forests south of the Gedu goes down the Hukong Valley. All the rubber that goes to Assam is carried by Naga coolies who can always be had after the crops have been gathered and who are probably more efficient when working in their own country than any other coolies in India. Taronku, the great rubber centre of the tract under notice, is situated at the Taron-Gedu confluence and the most valuable portion of the forest lies up the Taron river to the Chaukkan pass, along the route traversed some years ago by Colonel Woodthorpe and Major Macgregor. At Taronku a fee of Re. 1-8 or three seers of rubber is levied on every man who wishes to cut rubber in the forest. Besides this fee, Namyung village also collects tribute from the cutters passing through it. Rubber in this tract is getting scarce every year, as the trees are overworked, and it often takes a man no less than forty days to collect a coolie load of rubber. Most of the trees seen by Mr. Way's party had been tapped, and up the Loglai and Turong rivers the trees near the streams are either dead or dying from being overworked. Here the Singphos entirely control the Nagas and stand to them says Mr Thompson in very much the same position as a tea planter and his coolies Their word is law and is enforced by a very few Singphos over a great number of Nagas. The number of rubber-cutters who leave their villages for the Turong forests is known, and even if they succeed in evading the impost of the Singpho villages through which they pass, they would inevitably in the long run have to pay up The rubber when first collected is fairly pure but the Nagas have learnt from the native bunnias the trick of adulterating it with earth and stones, and so Assam rubber is not looked on with favour by Calcutta brokers It may be added that the same applies to the rubber that finds its way into the Rangoon market the Chinamen being adepts in skilfully concealing in the rubber earth and stones, principally the latter

With regard to protecting the rubber forests in those remote regions, Mr Thompson rightly says that in the absence of any means of enforcing the Forest Rules on the subject it is not likely any attention will be paid to them Sawbwas informed him that they are unable to enforce the rules or interfere in any way with the collectors On this branch of the subject Mr Thompson writes —'Regarding the Hukong Valley itself I think we are powerless to protect the indiarubber forests by any legislative methods, unless we are prepared to take the country over and administer it directly The Singphos are an exceedingly independent race, and at present really recognize no one as masters Under these circumstances if we are not prepared to take over the country, and if we still wish to preserve the rubber forests from extermination there is only one course left open to us, and that is to put a prohibitive tax on all rubber exported to the Myitkyina district from that Valley Of course there will be a great outcry from the Chinese firms engaged in the trade and from others but unfortunately the choice of alternatives is very limited and no half measures are possible The forests must either be completely protected or left alone, the Singphos would appreciate no other course of action The protection of rubber trees growing in forests situated within our sphere of direct administration, though a difficult matter where Kachins are concerned need not present any really serious obstacles, and it is possible that if reserves are made of the richest areas, and the local Sawbwas in whose jurisdiction the reserves would be situated were induced to interest themselves in the protection of the forests, and that the subordinate forest officials appointed to supervise them were selected from amongst some of the better class of Singphos, a great deal may be done towards the protection of this tree.'—*Rangoon Gazette.*

The Result of the Disappearance of Forests in Trinidad.

It is pointed out in the *Bulletin of Miscellaneous Information* of the Royal Botanic Gardens, Trinidad that the rainfall for that island is slowly but surely decreasing The average rainfall for the decade 1862-71 was 66 715 inches , for the next decade (1872-81) it was 65 993, and for the third decade (1882-91) it was 65 037 The decrease indicated by the first and third values is 1 678 inches or 2 51 per cent during the thirty years from 1862 to 1891 Presuming that the same rate of decrease runs on for the next sixty years, Trinidad will then suffer from a rainfall diminished by about 8 inches Mr Hart points out that a rainfall decreasing at such a rate is alarming , and if the inference is carried on it follows within there a measurable distance of time Trinidad must become an arid desert as barren as the Great Sahara The cause of the decrease in said to be the disappearance of the forests —*Nature*

Forestry in Belgium.

The latest progress in this go-ahead little country is the organisation of a special branch of the Forest Service called the Research and Consultation Branch Its work will be of two kinds, as shown by its name The staff will be occupied in carrying out regular and methodical experiments in sylviculture a matter which might well be commended to the attention of the Government of India, and in visiting private forests and advising the owners in cases where opinion or assistance may be desired In India, where our knowledge bears so small a proportion to our ignorance, there is a fine opening for the acquisition and collection of needful information on almost any point that could be mentioned in connection with the growth and treatment of every individual species or crop Each province should have its branch, working under central direction

The Bicycle—A Forest Invention.

The bicycle is used now by many foresters for their work as well as pleasure Its first inception is due to a forester, the Baron de Drais Grand Verderer, or whatever he was called, to the Grand Duke of Baden. The original machine resembled a " bone shaker " without pedals The rider sat on the saddle and propelled it in a manner similar to skating Having patented it in 1818 under the name of Draisienne, the Baron brought it to London, and it had a short vogue there at Bath, and elsewhere, under the name of hobby-horse, but was killed by public ridicule, which nearly killed the inventor too, for he returned to Baden a broken and disappointed man, and they put up a monument to him at Carlsruhe A certain M Paul Clerc now has resuscitated the Draisienne under the name of "celerrette" (nothing to do with whisky) and claims that by the use of ball bearings and pneumatic tyres it can be propelled almost as fast as a bicycle Made in wood he hopes to see it used even on forest roads, where its lightness will enable the rider to carry it easily under his arm when he comes to absolutely unrideable places

The Early Flowering of the Nim Tree.

Mr D N Damle writes to us from Karad in the Sattara District that, probably owing to deficient rainfall, the nim tree (*Melia indica*) has flowered and ripened its fruits nearly 5 months earlier than usual

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

February 3rd, 1897.

East India Teak.—The deliveries in the past January have been 1,777 loads against 2,207 loads in the same month a year ago. Prices have been firmly maintained and there is no element of weakness visible ahead of the market.

Rosewood—East India.—Is asked for, and small shipments of good logs would sell well.

Satinwood—East India.—Stocks are now low, and figury wood in either logs or boards would sell well; small shipments are, however, best.

Ebony—East India—Good logs, in small lots, would realise fair prices.

PRICE CURRENT

Indian teak	per load	£11	to	£16
Rosewood	„ ton	£8	to	£10
Satinwood	„ sup foot.	8d	to	12d.
Ebony	„ ton	£7	to	£8

MARKET RATES OF PRODUCE

Tropical Agriculturist, February, 1897.

Cardamoms		per lb	3s. 1d.	to	3s 2d.
Croton seeds		per cwt	77s 6d.	to	80s.
Cutch		„	30s.	to	32s. 6d.
Gum Arabic, Madras		„	37s 6d.	to	45s
Gum Kino		„	£45	to	£55
Indiarubber,	Assam	per lb	1s 10d	to	2s 4d.
„	Burma	„	1s. 4d	to	2s 1d.
Myrabolams,	Madras	per cwt.	3s 9d.	to	5s. 6d.
„	Bombay	„	4s. 3d.	to	7s. 6d
„	Jubbulpore	„	4s.	to	6s. 6d.
„	Calcutta	„	4s.	to	6s.
Nux Vomica, Madras		„	6s	to	7s. 6d.
Oil, Lemon Grass		per lb	2⅝d.		
Orchella, Ceylon		per ton	10s.	to	21s. 6d.
Sandalwood, logs		„	£30	to	£50
„	chips	„	£4	to	£8
Sapanwood,		„	£4	to	£5
Seed lac		„	70s.	to	80s.
Tamarinds		„	9s.		

Statement of average selling rates of timber and bamboos in Moradabad, Delhi Bareilly, and Pilibhit for the month of January 1897

Description	Timber scantlings per score		Bamboos per 100 score		Remarks
	From	To	From	To	
	R A P	R A P	R A P	R A P	
MORADABAD					
Sál 10 Tors (Poles)	20 0 0	25 0 0			
Sál and Sain &c, Karis 12 × 5 × 4 — Sal	50 0 0	60 0 0			
Sál and Sain &c, Karis 12 × 5 × 4 — Sain	30 0 0	40 0 0			
Sál bed posts 7 × 2½ × 2½	0 8 0	0 10 0			
Bamboos of 9 to 10 per 100 score			50 0 0	75 0 0	
DELHI					
Sál, 10 Tors (Poles)	5 0 0	7 0 0			
Sál and Sain, &c Karis, 12 × 5″ × 4 — Sal	30 0 0	58 0 0			
Sál and Sain, &c Karis, 12 × 5″ × 4 — Sain	18 0 0	25 0 0			
Sál bed posts, 7 × 2½ × 2½	8 0 0	9 0 0			
Bamboos of 9 to 10′ per 100 score			20 0 0	75 0 0	
BAREILLY					
Sál 10′ Tors (Poles)	5 0 0	10 0 0			
Sál and Sain &c, Karis 12 × 5″ × 4′	25 0 0 40 0 0	35 0 0 50 0 0 60 0 0			
Sál bed posts, 7 × 2½ × 2½	10 0 0	25 0 0			
Bamboos of 9 to 10′ per 100 score			50 0 0	137 0 0	
PILIBHIT					
Sál, 10′ Tors (Poles)	15 0 0	20 0 0			
Sál and Sain, &c, Karis 12 × 5″ × 4	25 0 0	30 0 0			
Sál bed posts, 7 × 2½″ × 2½	6 0 0	7 8 0			
Bamboos of 9′ to 10′, per 100 score			44 0 0	50 0 0	

THE INDIAN FORESTER

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Obituary—Mr. James L. Laird MacGregor.

Indian foresters will have learnt with the deepest regret of the sad death of Mr. J L Laird MacGregor, Conservator of Forests, Bombay, on the 28th of February last whilst following up a tigress he had severely wounded ; he was charged by the animal and received such serious injuries that his death resulted on the following day He died at the beautiful village of Supa, situated in the heart of the glorious North Canara Forests he loved so well.

The dead body of the tigress was found subsequently about 200 yards from the spot where she had mauled Mr. MacGregor, and it would appear that she died almost immediately after the occurrence

His death is keenly felt by all who knew him A thorough gentleman, a keen sportsman and the very soul of honour, he was respected and liked by all with whom he came in contact

Mr MacGregor was born on the 9th of February 1848 and originally selected the Army for his profession, and he served for a short period in a British regiment as a subaltern, but the newly created Indian Forest Service offering greater attractions to his adventurous spirit, Mr MacGregor, after passing the entrance examination of the Indian Forest Department, went through a course of training at the German School of Forestry at Tharandt, and was sent out to India. Upon his arrival in this country in January 1872 he was appointed to the Punjab Administration where he served about 18 months and from there was transferred to the Bombay Government and was posted to the Belgaum Division where he s[illegible] as Divisional Forest Officer until in December 1886, upon the retirement of Colonel W. Peyton, he was appointed Conservator of the Southern Circle.

The Southern Circle of Bombay, including as it does the magnificent teak-producing areas of North Canara, as well as the valuable fuel forests of Belgaum, is one of the most important charges in British India.

Prior to the appointment of Mr MacGregor as Conservator little or nothing had been attempted in the way of systematic management, and it devolved upon that officer to introduce the principles of scientific forestry and to commence the task of breaking up these vast masses of unregulated forests into workable series and substituting an orderly in the place of what had been hitherto a haphazard system Only those who served under Mr MacGregor can realize with what zeal he applied himself to this arduous duty which unfinished, though far advanced, must now be left to his successors It may be safely said that the essential principles which guided him during his administration of the forests were simplicity and accuracy in organization, efficiency in protection and due attention to financial results His views in regard to this latter have been the subject of controversy on the part of Forest officers in this country, but it is probable that his natural shrewdness made him cognizant of the fact that the British as a nation are not greatly devoted to forestry in the modern sense of the term, and that in this as in other matters they are more susceptible to large and quick returns than to other considerations

During his tenure of office much has been effected in the shape of organization and much more in the form of protection Working plans have been made or are in progress for all the more important forests of North Canara and Belgaum fire-protection has become a well established reality and the greatest attention has been paid to the subject of reproduction In short his career as Conservator has been a record of good and honorable service, beneficial alike to Government and the forests of which he was in charge

Amongst the members of the subordinate establishment his name has served as a symbol of honest and upright dealing whilst by his own brother officers he was respected for his intelligence and keen sense of duty and esteemed for his unfailing geniality and thoroughly good nature In his death the Forest Department has sustained a great and his friends an irreparable loss

As an author, Mr MacGregor will be remembered for his 'Organization and Valuation of Forests published in 1883 and his 'Forest Organization for Beginners' which appeared in the *Indian Forester* Both are works of great merit, receiving much attention at the time of their publication and raising their author to a very high place amongst the European foresters of the day

The Forests of Prussia.

M Hueffel, Professor at the Nancy Forest School, has just published an abridged French translation of The Forest Statutes of Prussia by M Donner, Head of the Prussian Forest Service The forests of that Kingdom comprise 8,192,500 hectares, or

23½% of the whole country Private owners possess a little more than half of the total, the State and the Crown possess nearly ⅓rd, communes and public institutions own the remaining 1/6th. The principal forest regions are the Eastern sandy plains and the Western mountains In the East, *Pinus sylvestris* alone covers 3,000,000, hectares, or ¾ths of the entire area in the provinces of Prussia, Brandenburg, Pomerania, and Posen The whole Kingdom contains 4,346,000 hectares of this tree, the average production of which is put at 3 29 c m per hectare, 0 81 c m of which is large timber In the State forests, the possibility is put at 3 03 c m whilst in Saxony it is 6 45 c m and in Bavaria 5·18 c m The net revenue from these State forests is 25 57, 65·69, and 39 14 marks (or shillings) respectively

The administration considers that the forests, whether
'belonging to the State, or to private persons, are a property which
'we have received not made, and which it is our duty to hand
'down intact to our successors Indeed, the effects of forests
upon climate water supply, health, &c , render them indispensable
'to the equilibrium of every inhabited country Private owners
'are tempted to ignore this responsibility, and the results of dis-
'forestment have been that large areas have been rendered sterile,
'moving sandhills along the sea have covered fields and villages,
'and threatened inland navigation, the accumulated vegetable soil
'of thousands of years has been washed from the mountains,
'and after it the mineral soil, hindering agriculture, raising
'the beds of the rivers, and exposing the plains and valleys to
'floods A striking example of the results of disforestment is
'found in the *Kurische Nehrung* a zone of littoral sand dunes
'60 miles long near the Russian frontier (Courland) between
'Memel and Konigsberg, which divides the Baltic from the great
'lagoon called the 'Kurisher Haf ' This region has now be-
'come completely desert, and the hindrance to navigation is such
'that it will be necessary to go on spending for more than a
'hundred years sums whose interest alone is annually more than
'the whole value of the forests destroyed "

The same thing has happened in the Alps, in the Pyrenees at the Combe de Péguère, &c The chapters on departmental organisation have no particular interest for us at present, but the principles taught in sylviculture and working plans concern us nearly The Forest School at Eberswald is very complete and well provided for, possessing a park, nurseries, and even a pisciculture branch For practical work it has the entire management of four forest blocks totalling 18,000 hectares (45,000 acres, over 74 sq miles)

" The Prussian Forest Administration formally rejects the
'theory of those who consider that the object of treatment should
'be the production of the greatest possible *net* * revenue in

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* The Bodenreinertrag, or net revenue of the soil, is what remains after deduction of all expenses, and of the *interest on the capital engaged*.

' money, and who go in largely for compound interest tables On
' the contrary, it holds that the State differs from the private
' owner, in having an essential duty to perform, namely, to direct
' the treatment of the public forests with a sole and strict eye to
' the greatest public good not only with regard to forest produce,
' but also regarding the indirect effects and looking at the subject in
' its widest and most general application The forests should
' neither be made an object of financial juggling nor even regarded
' as a capital sum expected to bring in a certain rate of interest
' They are a trust deposited in our hands for good management
' during our generation The usufruct indeed is ours to the fullest
' extent but we have no right, either to take more than the usufruct,
' or, to alter the constitution of the property , that is to say, we
' are entrusted, not with a certain sum working at a certain rate
' but with *forests*, FORESTS and nothing else, and let us look to
' it that our successors find them in at least as good a state as we
' did."

The Prussian administration thus rejects absolutely the commercial exploitability for State forests Will it be accused like the late Mr A'Arcy, of pure sentimentalism ?

The forests are worked at a long rotation Assuming age-classes of 20 years interval it is seen that in State forests the trees of 80 to 100 years and over only cover 13% of the area, and that therefore the stock corresponds nearly to an exploitable age of 100 years The greater part of the pine forests being worked at a rotation of 120 years, and the oak forests at 160 years, it follows that the material as a whole is insufficient

" For some years past, there has been a marked tendency
' towards the simplification of working plans especially in pine
' forests The tendency is to work more by area, allotting a given
' block to a given period, without paying too much attention to
' a distant and problematical increment-expectation After ab-
' straction of blanks, the reduced area divided by the number of
' periods gives the average area of the periodic block The first
' block contains crops which may, for one reason or another, not
' be prospering, together with a sufficient area of the older crops
' to make up the amount required Very rarely does the first
' block contain more than the normal, and then only because the
' older crops happen to be distinctly in excess If any fellings are
' necessary in the other blocks, the volume of trees so felled is
' ascertained and an area carrying that volume of trees when ex-
' ploitable is excuded from the first block Pursuant to this system
' of simplification, all estimations of volume beyond the first
' period of 20 years are dispensed with."

Reading the above, one seems to be back in the lecture theatre at Nancy, where this very procedure was taught many years ago. The possibility, even for intermediate fellings, is always expressed in c. m, The increment is allowed for at a moderate rate,

The Palmyra Palm.

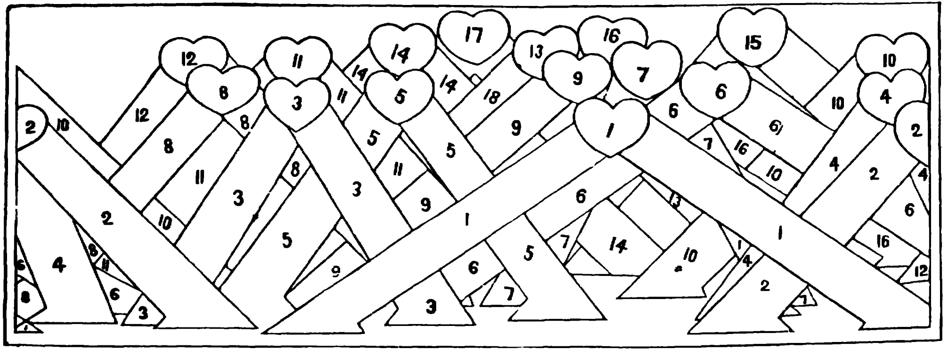

Diagram showing part of the circumference of a Palmyra tree rolled out. Leaves cut off just above the sheath of the petiole. Sheath broken in all cases.

Scale 1″ = 4″.

The regeneration of the pine is generally sought artificially, by planting in most cases, after a clean felling But on the sands the young plants are often destroyed by cockchafer larvæ, and the Prussian foresters have an embarrassing choice between this difficulty and that of natural reproduction by seed In the Eastern provinces where the pine will bear a little cover, they have adopted the method of groups or wells, freeing any patches of seedlings that may arise under the cover and progressively enlarging the patches as seedlings appear on the borders In this case it is generelly necessary to regenerate two blocks at once (⅓rd of the area with a rotation of 120 years) or even over larger areas which approximates the system to that of jardinage Nevertheless it cannot be said that natural reproduction is difficult in a country that has millions of hectares of pine and the German foresters will surely find out the secret At present they are seeking a method of small coupes which may lead them to the possibility by area In pine forests this would be so simple so clear, and self-evident that it is astonishing to find the best foresters of Europe still entangled in volumetric calculations Will the Americans have to come to the rescue? They are not the people to go playing around measuring every tree from Florida to Vancouver with a shoemaker's measure not even though perfected by Edison Some day—who shall say how soon—the possibility by area may return to us from America, as pippins from Canada

CH BROILLIARD

(*Translated freely from the "Revue des Eaux et Forêts" by F. G*)

II—CORRESPONDENCE

The Palmyra Palm

I send herewith a diagram drawn quarter size showing how very closely palmyra leaves can sometimes pack themselves on the stem Of course the majority of the leaves die off, only about 6 or 8 remaining alive at a time The diagram is supposed to represent the unrolled circumference of the tree, and in a height of 8 inches from base of petiole to base of petiole 17 leaves were crowded together The young leaf petiole, when green, is sheathing, but when the leaf dies and the stem distends, the sheath splits, making the base of the petiole appear forked. A scar is left behind on the stem the whole horizontal length where the leaf has at any time adhered The leaf scars form almost continuous spirals round the tree, and I fancy that by their means a rough approximation of the age of the tree can be made Here the trees yield on the average 10 leaves per annum , 17 leaves gave 11 rungs of the spiral ladder so that there would be 6 such rungs per annum This requires further elaboration, but I thought perhaps this might be of interest to you

Since writing the above I have had the opportunity of examining a great number of palmyras and find that almost invariably the leaves come off the stem in whorls of 3, the bases of their petioles either touching or slightly overlapping This fact is rather interesting as an extension of the trimerous formation of the floral organs of most monocotyledons Of course the three leaves of the whorl in palmyras are not synchronous one develops after the other Since writing I have also come across the following, in Lindley's Introduction to Botany —

' It is said that the number of external rings which indicate
' the fall of leaves from the trunk of the Palm tribe coincides with
' the number of years that the individual has lived There is,
' however no proof of this at present such statements must there-
' fore be received with caution

If as is said from 10 to 12 leaves form in each year (I am now making experiments to test the accuracy of this), then, as three leaves go to form one of the external rings above referred to, from three to four of these external rings coincide with a year's growth, and not one only

A W Lushington

Annual Rings in the Nim Tree.

In Gamble's Manual of Timbers it is remarked that it is not known whether the rings in the wood of the Nim tree (*Melia indica*) are annual or spurious There is a forest plantation of Nim at this place (Tummuru Kodu) in which Nim trees were planted 14 years ago I had some of them felled lately, and examined the rings I found that the 14 annual rings were clearly marked but that in addition there were other spurious rings which however did not go round, but merged into the annual rings In fact the spurious rings seldom went more than a quarter way round If the rings of the Nim are counted care will have to be taken about these spurious rings

A. W. Lushington

Forest Terminology

I notice that the words "stool" and "stool-shoot" are being applied to the stump of a tree felled flush with the ground and to the coppice shoots that spring therefrom I do not know why any more modern terms than the good old words "stump" and "coppice shoots" are wanted, but if they are why adopt *wrong* terms?

A 'stool" is "the parent plant from which young individuals "are propagated by the process of *layering*" (Lindley's Introduction to Botany, Book I page 84), and therefore a "stool-shoot" is nothing more nor less than a 'layer"

A W LUSHINGTON.

IV.-REVIEWS

Review of Forest Administration in British India for the year 1894-95 by B. Ribbentrop, C. I. E., Inspector-General of Forests.

In accordance with our usual practice we propose to give a brief account of this interesting Review with selections of the most important portions of it

Area—During the year 1570 square miles were added to the Reserved Forests of the Bengal Presidency, 694 square miles in Madras and 675 square miles in Bombay There were 257 square miles of exclusions, so that the total at the end of the year came to 74,271 square miles The protected forests aggregated 7090 square miles and unclassed forests 31 591 making the total of all classes under the Department 112,952 square miles Settlement is going on well and is said to be approaching completion in some provinces, while in others, notably Madras, it will take 5 or 6 more years

Demarcation—A detailed form gives the details of the progress of this work, the net result of which for the Bengal Presidency is that 44,889 miles of boundary lines are now demarcated while 5741 miles still remain to be done

Surveys—A map is given on which are shewn in red the areas for which Survey is completed and in green those which still remain to be done Four parties of the Survey of India were at work as well as the Forest Survey Branch Altogether Rs. 1,19,169 were spent by the meet Survey Branch and Rs 3,69,419 by the Survey of India

Working Plans—On this subject, we shall do best to quote the following remarks of the Inspector-General of Forests :—

“ During the year ten working-plans, dealing with an area
‘ of 1,760 square miles, were sanctioned, and the area under re-
‘ gular systematized working stood at 9,423 square miles, or 12
‘ per cent of the forest area, at the close of the year Large areas
‘ remain to be dealt with especially in Bengal, Punjab, the Cen-
‘ tral Provinces Upper Burma, and Assam A considerable pro-
‘ portion of these areas consist of forests in which, owing to the
‘ absence of markets, the production is far in excess of the demand,
‘ and in such cases the preparation of working-plans though
‘ desirable is not a work of immediate necessity On the other
‘ hand wherever there is a steady demand and more especially
‘ where this approaches the production of the forests, the introduc-
‘ tion of plans of working defining the main objects with which
‘ the estates are to be worked and the amounts of forest produce
‘ which can safely be utilized is of the greatest importance ’

“ With regard to the control of existing working-plans, it may
‘ be said that year by year as what is required becomes better
‘ understood, the plans prepared become clearer and more practical
‘ in their provisions and that more and more attention and care is
‘ exercised in carrying them out During the year under review,
‘ generally speaking the provisions of existing plans were well
‘ carried out When deviations occurred through force of circum-
‘ stances these were reported to and sanctioned by the Local
‘ Government concerned It may here be noticed that as the num-
‘ ber of plans increases—and this is taking place with rapidity—the
‘ work of controlling them becomes more laborious , and the time
‘ will sooner or later arise when the control of working must be
‘ placed more directly in the hands of Conservators

Communications and Buildings—On this important subject the Inspector-General makes the following remarks

“ Considerable activity was displayed on the construction and
‘ maintenance of export roads connecting the forests with the
‘ markets they supply In some provinces it was found necessary
‘ to construct roads outside the forests In the Bengal Presidency
‘ Rs 55 677 were spent on new roads and Rs 76 021 on repairs
‘ In Madras Rs 32 007 and in Bombay Rs 2 918 were spent on
‘ road work The highest expenditure (Rs 64 721) took place in
‘ the North-Western Provinces and Oudh where an excellent sys-
‘ tem of roads exists, without which the produce of the forests would
‘ be unsaleable ’

“ It is to be observed also that the construction of railways near
‘ or through the forests has in some instances considerably increased
‘ the demand for forest produce of all and more particularly of
‘ inferior kinds Good sound timber of large dimensions general-
‘ ly commands a ready sale But the supply of such is but limited,
‘ and in the case of most of our forests owing to the want of easy
‘ communication with the markets and the consequent cost of ex-
‘ traction, the mass of timber of inferior quality or species, as well

'of minor forest produce remains unsold. The construction of 'railways, such as that through the Oudh forests and that of the 'projected lines from Nazibabad to Kotedwar will assuredly tend 'to the development of trade in such products."

"Attention was also directed, particularly in the North-West- 'ern Provinces and in Madras, to the construction of rest-houses, 'and to providing suitable accommodation for Range officers and 'subordinates. In the Bengal Presidency Rs. 1,11,660 were spent 'on new building work, and Rs. 51,692 on repairs. In Madras 'Rs 34,143 and in Bombay Rs. 17,802 were spent on building 'work."

At first sight it might seem as if this was a large sum, but in reality it is very small, amounting only to 3·4 Rs. per square mile of forest under management If the supply which our forests are capable of yielding is to be made fully available for the use of the country, much more than this must be spent in roads for export and in the proper housing of subordinates. The latter is a matter of great importance, for we hold that in order to obtain an efficient and honest staff of good education, they must be properly housed and properly treated.

Fire-protection —We are glad to see that Mr. Ribbentrop realizes that any comparison between cost-rates is of very little use when the circumstances of different Circles, different Divisions and even different pieces of forest are so varied as to make such a comparison most difficult and the conclusions drawn from it often most misleading. He says :—

"Even though allowance were made for the variations in the 'labour-rates in the various provinces, the difference in the con- 'ditions affecting fire conservancy are too great and manifold to 'permit of any useful comparison between the cost-rates. We 'have to do with grass-fires, with bush and with leaf-fires, and to 'meet endless varieties under each class. For instance, as regards 'grass-fires, circumstances may require the early cutting of broad 'traces through belts of dense grasses in which an elephant cannot 'be seen, and of burning the dry grass thereon before the adjacent 'jungle is inflammable. Narrow traces are of no use in such 'localities, as the fire, coming from the outside, would cross them. 'It is evident that operations of this kind, in order to be effective, 'cause a large amount of labour and a considerable outlay, whereas 'in other localities the grass may only be a few inches high, 'and here the outward firing may be controlled with the greatest 'ease by cutting a path a few feet broad, and in some cases even 'this is not required. Between these two extremes numerous 'variations exist, requiring more or less expensive measures in 'order to isolate the forest to be protected. Again, as regards 'leaf-fires, all depends on the time and manner in which the 'various forests shed their leaves. In some cases this happens 'before the fire-season commences and a single sweeping and

‘ burning of fire-traces suffices to protect the forests, whereas in others the shedding of leaves continues all through the driest weather and renders necessary a continuous attention to the clearing of the fire-trace. Thus, for instance, a fire-trace through a *Pinus longifolia* forest is entirely intractable, and forests of this character can only be protected by the sacrifice of a broad belt on which all growth of the species is prevented, thereby changing the character from a leaf-fire to a grass-fire protection. In how far the adoption of this measure is advisable in deciduous forests depends entirely on local conditions and cases have occurred, where the cutting of a broad belt through the natural forest was followed by a grass-crop so dense and high as to render fire-protection more laborious and costly than it was before. The character of the surrounding country also greatly influences the difficulty and cost of fire-protection.”

“ It will be seen from the table at the beginning of this section that out of 30,963 square miles the special protection of which was attempted 28,913 were saved and 2,050 square miles were overrun by fire.”

In regard to the forest fires in the Punjab, the Inspector-General quotes from the Government of India Review of the year's report as follows but whether the authorities of the Province will take any action in the matter remains to be seen.

“ The attempts at fire-protection were even less successful than in previous years, there having been a marked increase in the areas burnt over in all but the Chenab, Chamba and Umballa divisions. It is observed with special regret that the grazing concessions which were given in the Hazara division in order to obtain the good-will of the people were immediately followed by the burning of the opened area, with the alleged object of obtaining fresh grass. The Government of India hope that every effort will be made to impress upon the people the scope and object of the concessions, and that they will be withdrawn without fail in regard to all areas burnt. It is noted with concern that a great proportion of the fires took place in specially protected areas. The continued failure to protect the forests from fire so seriously affects the permanent well being of the country that the Government of India agree with the Lieutenant Governor that where wilful burning is proved, whether with intent to do damage or in order to obtain new grass, the punishment should be exemplary and deterrent.”

We have already commented in this magazine on the question of fire in the Burma teak forests, so need say nothing more now.

Grazing.—This subject is rather fully discussed and it is pointed out that the idea that forest conservancy should, as far as possible, be restricted to remote regions for the growth of timber (surely ‘ of gigantic trees ’ can only be slightly sarcastic !) has been gradually abandoned and consequently the mass of the forest areas are expected to supply not only wood material but also a certain amount of grazing The discussion is too long for quotation, so we need only refer our readers to the report itself.

Reproduction —We cannot do better than quote at length the long and interesting account of reproduction in the various classes of Indian forests which Mr Ribbentrop has drawn up.

"The principles of sylviculture are the same all over the world but their application varies according to circumstances and conditions, and in this respect every conceivable variety is represented and has to be dealt with in India The extent of the forest areas and the comparatively small income per acre necessitates, in most cases a sylvicultural treatment solely based on natural reproduction and the questions involved require the Forest officer's constant study and thought It is true that in the majority of our forests, especially in those which are the more valuable ones from a purely fiscal point of view natural reproduction advances satisfactorily under a continuous protection from fire and cattle, but this alone is barely sufficient for the maintenance and improvement of the character of the crops, as the species composing the *peuplement* in Indian forests vary in value to a much greater extent than is the case in Europe for instance "

'In the gregarious pine forests in the North-West Himalayas, it is the deodar to which the preference must be given in all suitable localities Its value is twice that of any other pine, and in many cases it is the only species which can as yet be profitably extracted The treatment of these forests offers, consequently, considerable difficulties, especially in localities which, on account of their position, exposure and soil, are more favourable to inferior species Good progress has, however, been made in the study of this class of forests and their reproduction, and working-plan prescriptions for their treatment now rest on a comparatively safe basis It has often been found necessary to assist the natural reproduction of the deodar by cultural operations, planting or the dibbling in of seed on prepared plots or lines, and by the felling or girdling of inferior pines in advance growth of the better species These operations are now fully understood, not merely by the supervising ranger and forester, but by the work-people, and success almost invariably attends their execution "

'The sal forests in the Sub-Himalayan tracts in the Garo Hills, and in the belt extending from the Bay of Bengal to the Vindhya Range form another class of more or less gregarious forests, in which reproduction is, as a rule, sufficiently abundant wherever an efficient fire-protection has been secured and grazing has been regulated and restricted. At the outset of regular forest management, the prevalence of frost in exploited localities often caused great anxiety and trouble In others it was the rapid growth of high grasses which interfered with reproduction, and on clayey soils the dense crop of a young 'growth of *Terminalia tomentosa*—a tree by no means unmarket- 'able, but of less value than sal Here again, however, it may be 'asserted that the study of the characteristics of this class of forests 'and their behaviour towards the dangers which mainly threaten 'their satisfactory reproduction has sufficiently advanced to secure 'a fairly correct and generally successful treatment"

"The areas of deciduous forests which cover the greatest part 'of the country, from the southern slopes of the Himalayas to Cape 'Comorin, as well as in Burma, may for our purpose of reviewing 'the value of reproduction, he divided into two main classes —

(*a*) Those which contain the teak, the padouk, the cutch, the ironwood, the red sanders and sandal and any other of those trees, which, on account special qualities, command a sale beyond the local market and exceptional prices, and in which the application of sylvicultural principles is consequently mainly directed towards increasing the proportion of the more valuable species in the crops of the future

(*b*) Those forests which are situated outside or near the margin of the habitat of such trees, and in which species are absent or sparsely represented In such forests which are treated for the local supply of timber and firewood only, no pronounced measures are required in favour of any particular species, though of course even here one or several kinds of trees are usually more valuable and useful than others and their reproduction is naturally favoured by retaining them as parent trees for the new crops

"Amongst the deciduous forests of class (a), those containing 'the teak are the most important, not merely of this class but of all 'forests in India They have frequently an additional value owing to 'the presence of cutch, ironwood, padouk and other valuable species 'Their reproduction and improvement offers an inexhaustible study 'to the forester, and has probably received more attention in this 'respect than any other class of forests Pure teak forests, and 'even such in which the teak forms the main part of the crop, are 'rare, especially in the eastern and more more important zone of 'the tree, and are found only in specially favourable localities. In 'forests of this character reproduction presents no difficulties, a 'judicious exploitation and protection are all that is needed to en- 'sure favourable results Where, however, the teak tree is found 'intermixed with other species, and, as is often the case, forms only 'a small percentage of the mature crop, the chances of reproduction 'of the more valuable species are lessened with every mature teak 'tree which is removed In such forests favourable results have 'been frequently achieved by girdling trees of the inferior classes 'round or in the vicinity of teak seed-bearers, thus producing an 'advance growth of the superior species before the mature stems are 'removed. All natural advance growth of teak is in such localities

‘fostered even at the sacrifice of mature trees of less value, and
‘though such interference may be of limited extent only in each
‘case, the aggregate of the forests improved in this manner repre-
‘sents a large and important area ’

“The existence of a bamboo forest beneath the canopy of the
‘tree-crop renders the natural reproduction of teak a question of
‘special difficulty The forests in which this difficulty exists are
‘very extensive and in the eastern zone cover by far the largest por-
‘tion of the teak areas These bamboo forests vary in character in
‘accordance with soil and situation, from the light cover of *Dendro-*
‘*calamus strictus* to the dense shade of *Bambusa polymorpha* and
‘*Cephalostachyum pergracile* The former species, which flowers
‘sporadically as well as gregariously, does not entirely prevent the
‘natural reproduction of tree growth, and in forests with an under-
‘growth of this character representative of teak of all age-classes
are usually found frequently accompanied by cutch The dense
‘cover, however, of the periodically and gregariously flowering
‘bamboos renders natural reproduction of teak almost impossible,
‘except during such periods of flowering This fact accounts for the
‘existence of tree-crops separated in age by the length of these
‘periods It is useless, in respect of these forests to speculate and
‘report annually on the progress made in natural tree reproduction,
‘as a consequence of fire-protection, which only tends to make the
‘shade denser and more prohibitive towards the growth of seedlings.
‘In forests of this kind all measures must be and are preparatory to
‘the next occurrence of a general flowering, and thus the value of
‘fire-protection is great as one of the means of securing healthy
‘parent trees ”

“The prescriptions of all working-plans and the girdling pro-
‘posals framed under their provisions, tend in the same direction in
‘preserving a sufficiency of seed-bearers A special feature in the
‘treatment of these forests is the formation of teak *taungya* planta-
‘tions * These are scattered about in localities where, though

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*** I have recently been asked what a teak *taungya* is, and take this opportunity of explaining how the destructive method of shifting cultivation, in vogue amongst nearly all uncivilized tribes, has been utilized for arboricultural purposes The areas on which these people are permitted to cultivate are selected by Forest officers within the boundaries of fire protected reserves, the places chosen being those in which valuable species are absent, or but sparsely represented All forest growth on these areas is then felled and when dry is burnt, due care being taken to prevent the fire from spreading into the surrounding forests The ground is cultivated in the beginning of the rains, and the agricultural crop is interplanted at such distance as may be fixed usually 6 by 6′, with teak, cutch, or such other species as it may be desirable to establish At the beginning of the second year a certain fixed rate is paid for every 100 well established plants This method of tree-planting was first introduced in Burma, where the areas brought under shifting cultivation are called “taungyas ” If utilized for the cultivation of teak they were called teak *taungyas*, if for cutch, cutch *taungyas* As the name is well established in the province where the method originated and has been used in some other provinces, it would seem advisable to apply it to all India instead of using the numerous local names, and to accept the expression ‘arbori taungya ” for all cultural operations of this kind.**

situated within the natural habitat of the tree, the species is sparsely represented, and will, when a flowering of bamboos takes place, it is hoped, form so many centres from which the teak will naturally spread to other portions of the forest. These *taungya* plantations have in addition a considerable intrinsic value as timber-producing areas, for they already extend in Burma over 35,644 acres, and are the result of little more than twenty years' work. Some 2,000 acres a year have been added of late, and during the year under review the area was increased by 3,903 acres. Other cultural operation in bamboo forests such as the planting up of strips, were undertaken with the same purpose of establishing belts or plots of parent trees. In many instances such operations have shown excellent results but mostly at a cost which seems prohibitive if compared with *taungya* cultivation."

'Insufficient advantage was taken during the first year of the gregarious flowering of myinwa (*Dendrocalamus strictus*) which took place in the Bawbin and Toungnyo reserves in Lower Burma in 1893-94, but experience shows that useful arboricultural operations may be undertaken amongst this species at least, for a considerable number of years, subsequent to its seeding and before the new cover is fully re-established.'

'A general flowering of kyathaungwa (*bambusa polymorpha*) is to take place in Burma within the next few years, and as the fully grown forest of this species prohibited tree reproduction of any kind, systematic preparations, in order to take full advantage of the expected opportunity, are under consideration. It is believed that this species of bamboo like some of the other gregariously flowering kinds will send out no fresh shoots in the year previous to seeding, and thus give a timely warning. It is also probable that its clumps will die without seeding if felled just before it flowers, and that a clear field may thus be obtained for the growth of teak seed. The operations which will follow the actual seeding, and perhaps even the first cultural treatment indicated will probably necessitate the extensive use of fire, and this is a delicate procedure which cannot be extended beyond manageable limits, as it is essential that the fires should as far as possible be retained in the areas operated upon and that once cultivated, they should be scrupulously protected.

'Some time ago it was asserted by botanical authorities that the continued cutting of the young bamboo shoots would weaken the parent clump to such an extent that it would probably die within three years. It was with good grounds believed that if this assertion proved to be correct, the difficulty of naturally reproducing teak forests with an undergrowth of *Bambusa polymorpha* at all times, and not merely for a few short years during the seeding of the bamboos, would have been solved, and experiments in this direction have been continuously carried on in several divisions in Burma for the last four years. The results of these experiments are as yet inconclusive. They have, it seems, proved that the removal of the young shoots year after year does not lead to the death of the parent clump, or to any great apparent loss in its vigour ; but it was nevertheless found that the amount of shade cast on the ground had been materially lessened in consequence of these operations Under these circumstances it seems advisable that the experiments should be continued for some years at least and that the efforts to reduce the vitality of the bamboos might be assisted by the removal of the mature stems as well on the experimental areas The point in question, *viz* the natural reproduction of teak independently of the flowering of bamboos, is of sufficient importance to warrant any trouble and expense in its satisfactory solution, and in case the annual cutting of the new shoots, if carried out in addition to a heavy working of the mature crop, would remove the difficulty, practical effect, on a considerable scale, could be given to this scheme by a system of free licenses granted with the condition that the new shoots of the year should be cut at the same time The removal of new shoots during subsequent years would be a cheap operation "

‘ The Madras report, which contains an excellent *resumé* of reproduction shows that a fair reproduction of teak, ironwood and *Terminalia tomentosa* attended the gregarious flowering of bamboos on the Godavery river. Experiments made in the introduction of arbori-taungya cultivation in North Malabar have also met with success, and might probably with advantage be extended to other parts of the country especially to South Canara, where the paucity of parent trees of the more valuable kinds is reported to be the chief reason for the absence of seedings of these species The good results obtained with teak taungya cultivation in Coorg is also worthy of note ’

"The natural reproduction especially of teak, in the north-western teak zone, including principal centres of the tree (the Panch Mahals in the Bombay Presidency, the Melghat in the Berars and the Ahiri forest in the south of the Central Provinces) has been reported as satisfactory throughout, where fires have been excluded In the Panch Mahals, which are specially favourably situated for export to large local markets, this problem has not as yet been solved satisfactorily, and the young crop has as yet been cut down and decimated year after year over the greater part of the area Dense bamboos crops do not interfere with natural reproduction in this zone) to the same extent as in Burma, nor are the varieties of other less valuable trees so plentiful as in that country "

"The natural reproduction of cutch is, except on the limits of its habitat, very satisfactory In Burma, where, owing to the great development of the cutch industry, the tree is of special value, its reproduction is assisted by means of *taungyas*, considerable areas of which are cultivated year after year with great success "

" The natural reproduction of ironwood (*Xylia dolabriformis*), is, even more than that of teak and cutch, dependent on strict fire

‘protection , for, though the tree is a very free seeder, few of its
‘seedlings survive even the slightest leaf-fire In the Rangoon
‘Division in Burma where the tree was extensively exploited, dur-
‘ing the construction of the railways, previous to fire protection
‘having been extended to the forests whence it was extracted, con-
‘siderable areas have been more or less denuded of this valuable
‘species ”

A more careful examination of the deciduous forests in the
‘Andamans has proved the existence of satisfactory natural repro-
‘duction of the padouk tree ”

“The deciduous forests of the (*b*) class are to a great extent
‘treated for more or less local markets, which as yet do not, as a
‘rule, demand timber of large sizes in any great quantity, and the
‘prescription of systematic plans for their treatment rely to a great
‘extent on reproduction by coppice The main principle applied
‘to forests of this class is one of improvement in fellings, which
‘frequently, as, for instance in the Thana District in the
‘Bombay Presidency and in many parts of the Central Provinces,
‘assumes the features of a coppice under standards The coppicing
‘power of most of the species composing these forests has proved
‘to be considerable, and reproduction from these operations have
‘generally been fairly successful A permanent maintenance of the
‘forests cannot, however be relied upon from coppice shoots only,
‘and in some localities as evinced in the working plan of the
‘Godhra Mahal forest in the Bombay Presidency for instance, it
‘has already been found that some of the most valuable species
‘refuse to coppice any longer It is under these circumstances of
‘great importance that a good crop of seedlings is in most cases
‘found mixed with the coppice crop is the result of the operations
‘by which according to circumstance a larger, or smaller propor-
‘tion of the healthiest parent trees are left on the ground Where
the crop of seedlings is insufficient and where the forests of this
‘class are, owing to a large demand of special value, the natural
‘reproduction has been assisted by dibbling operations and even by
‘planting Special energy has in this respect been displayed for
‘many years in several of the districts of the Bombay Presidency
‘where cultural operations have been systematically carried out by
‘the agency of forest guards at very little cost to the State It is
‘hardly possible to gauge the influence such operations may have
‘had, but as a considerable admixture of seedlings in the forests,
‘thus treated, is reported to exist, it may be assumed that this is,
‘to a great extent, due to the continuous and energetic system of
‘dibblings adopted ”

“The coppicing power of the various trees and its maintenance
‘has as yet been incompletely studied and the work in this respect,
‘even under preconsidered plans, contains therefore a considerable
‘element of uncertainty, which careful observations, records and
‘time alone can eliminate ”

“ Generally speaking, it may be said that reproduction in the
‘deciduous forests has made good progress in all areas to which

‘protection against fire and grazing could be extended, and that,
‘though many and important questions remain as yet unsolved,
‘considerable advance has seen made in their rational treatment,
‘and the consequent improvement in the character of the new
‘growth The deciduous forests pass into dry forest areas in which,
‘owing to the limited rainfall the forest flora is a poor one, and the
‘individual trees are badly developed Within these areas the dif-
‘ficulties regarding fire protection diminish considerably, but re-
‘production without the strictest closure becomes more and more
‘uncertain The question how the dry forests in the Punjab *bars*
‘came into existence and how they reproduce themselves apart
‘from coppice in any but exceptional favourably situated localities
‘is as yet by no means solved

‘A sprinkling of seedlings is said to have been noticed in the
‘Multan *rakhs* but the process of reproduction from seed is so slow
‘that a very long period of strict closure would be required to
‘ensure the re-stocking of the forest in this way, and the results
‘would probably be quite out of proportion to the value of the grass
‘crops which would have to be sacrificed in the meantime Luckily
‘the coppicing power of the long-rooted species which constitute
‘these forests is wonderful Centuries seem to have made no differ-
‘ence but during that time these areas had not to supply fuel for a
‘constantly increasing network of railways and the continuity of
‘their vigour of coppicing under these changed circumstances is
‘by no means a certainty

‘Observations made of late years in Baluchistan show that the
‘conditions of natural reproduction of the juniper forest in that
‘country are more favourable than they were previously supposed
‘to be This is fortunate as the water available for irrigation is so
‘scarce and valuable that the establishment of extensive artificial
‘plantations had to be abandoned

‘Of the fringes of arboreal vegetation found on the banks of
‘rivers those on the Indus and its tributaries on their courses
‘through the plains are owing to their situation in a dry zone, the
‘most important Natural reproduction on *sailaba* lands, where
‘the trees are nourished by perennial percolation from the streams,
‘and on the large riparian areas subject to inundation during the
‘hottest months, is as a rule plentiful and satisfactory On the
‘former lands the natural original establishment of forests is fre-
‘quently a long and tedious process but where they have been
‘artificially constituted as for instance in Shahdera near Lahore,
‘they yield a considerable outturn and readily reproduce them-
‘selves both from seed and coppice ”

“Reproduction on the inundated areas in Sindh is reported to
‘have been seriously curtailed by the construction of dams, which,
‘it is asserted, considerably reduced the area formerly inundated,
‘and exposed others to exceptionally high floods which prevented
‘reproduction by a deposit of silt This may be the case, but there

'seems no doubt that new forest areas will constitute themselves 'outside the system of embankments"

"The reproduction of littoral forests, of which the Sundarbans 'is the most valuable representative, is always profuse, so long as 'the area is not raised above tide level which is a very gradual 'process and presumably accompanied by the same gradual addition 'of land elsewhere. In the Sundarbans, the sundri, the most 'valuable constituent of the forests, seeded abundantly and 77,000 'seedlings, 18 inches high, were counted to the acre on the Bangasal island"

"Reproduction in evergreen forests has been generally report'ed as plentiful and satisfactory in character, but these forests 'have nowhere as yet been extensively worked, and great difficul'ties will no doubt be encountered, where this happens on account 'of the very luxuriance of vegetation, which it will be difficult to 'guide in the direction most desired'

'The caoutchouc-yielding *Fici* grow mostly outside the sphere 'of safe observation in forest inhabited by more or less savage 'tribes and little is known as regards their reproduction

Outturn—The following are the figures of the total outturn of timber, fuel, bamboos and minor produce from the forests of the different Provinces for the year 1894-95 —

	Government	*Purchasers*
	CUBIC FEET	
Timber ...	5,727,264	39,923,591
Fuel ...	28,056,761	68,967,654
	No	
Bamboos	1 616,237	132,196,511
	Rs	
Minor Produce ...	1,88,654	30,25,197

It is explained that collections by Government agency are gradually giving way to export by the purchasers themselves

Finance—Here we notice that the figures for the 'financial" year are given instead of those for the "forest" year. We can easily understand that the figures which are given in the Budget reports are these which it is most convenient to use, and perhaps if this is admitted the arrangement of a 'forest' year may now be given up as a failure The *gross* revenue of the year was Rs 167,88,880 and the *net* revenue Rs 74,15,590 which is 44 per cent. of the *gross*, and Rs. 65 per square mile of land under forest control

For the first time, a statement is given of the value of the forest produce which is given free or of the loss by reduced rates to right-holders and grantees It amounts to the following :

	Rs.
Timber	7,86,013
Fuel	23,84,208
Bamboos ...	2,12,472
Minor Produce	9,35,461
Grass and Grazing ...	16,30,651
Total ...	59,48 805

By rights, this sum should be added to the revenue of the year to show the true results of the work, which would come to Rs 227 37 685 *gross* and Rs 1 33 64,395 net A Department which gives away free as much as 44½ per cent of the net income cannot be said to be quite so grasping and greedy as it is sometimes accused of being by those who do not or do not wish to know the facts

Education —The following remarks on the question of providing employment for the passed students of English extraction from the Dehra Dun Forest School will be read with interest

" A considerable number of Extra-Assistant Conservatorships ' have been created since 1891 under the reorganization of the ' department and many of these appointments have been obtained ' by students who passed out through the Dehra School previous ' to 1893 who thus have gained fair prospects of further promo- ' tion in the Provincial Service The result of this early promo- ' tion of a few officers who had the luck to enter the service at the ' right time has caused a continuous influx to the school of lads ' of English extraction and habits , and the fact that the Provin- ' cial cadre when once filled can only be entered after a prolonged ' service in the Ranger class on a pay rising from Rs 50 to Rs. 150 ' per mensem seems to be lost sight of by the parents and guar- ' dians of the young men competing for entrance into the Dehra ' College "

" The pressure is already beginning to make itself felt, and ' most of the Provincial lists contain a number of young men of ' English extraction on a pay of Rs 50 to Rs 80, which is entirely ' insufficient to support them in the manner in which they have ' been brought up The recent reorganization in Burma will oc- ' casion once more a certain relief in the pressure from below, and ' there is some prospect of the Siam Government indenting on ' India for some of its trained foresters of English birth. The re- ' organization of the Subordinate Service which is so much needed ' for a sound administration will also, when sanctioned, consider- ' ably improve the existing prospects ; for the scheme, as promul- ' gated, provides at least for a proper gradation in the Ranger's ' class, and for a fair proportion of appointments on Rs. 125 and

'Rs. 150. The fact, however, that the service, even after such 'reorganization has taken place, begins, as a rule on a pay of 'Rs. 50 and may, when fully organized, eventually necessitate the 'gradual working up through all grades of the Ranger's class 'until the Provincial Service can be entered, would hardly seem 'to render it particularly suitable for lads of English extraction 'No doubt a certain amount of selection will always govern the 'promotion from the Rangers class into the Provincial Service, 'and superior energy in the Subordinate Staff will always be 'rewarded in this way; but there are many trained Rangers of 'pure Native extraction who yield nothing in this respect to any 'one, and with whom the young Englishman has to compete on 'equal terms The influx of European students to the Dehra 'School has to some extent been encouraged by the frequency 'with which the maximum stipends were sanctioned by Local 'Governments to students of this class, who thereby became at an 'early age more or less independent of support from their parents. 'It was moreover concluded that the grant of such stipends placed 'the Government under the obligation to provide employment for 'the stipendiary students so long as they obtained a pass certificate, 'and this belief was no doubt fostered by the previous action 'of the various Forest Administrations In future the grant of 'such stipends will be considerably curtailed, especially as regards 'students of European extraction"

We are glad to see at the end of Mr Ribbentrop's Report, some remarks on the forest work done in the Native States We are surprised to see Travancore, where such excellent work has been done, omitted, and we believe there are other States especially in Bombay (*e g*, Kolhapur) which might have come in for some remark On the other hand, so far as we know, the work in Nahan has so far been rather a sham, but with the appointment of an experienced European Conservator a change may be expected Another year, also perhaps the Inspector-General might tell us what is being done in different Provinces in zamindari estates and especially in those under the Court of Wards The following are his remarks on the subject:—

"Copies of their Forest Administration Reports have been 'received by the Government of India from Mysore Kashmir, 'Jeypore and Jodhpur In Mysore and Kashmir, with a net forest 'revenue of Rs 9 20,000 and Rs 3,39,000 respectively, forest 'administration is, so far as can be judged from the reports, conducted 'much on the same lines as in British Provinces, and progress, 'especially in the selection and settlement of State forests 'and their permanent demarcation, is well maintained"

"The forest property in both these States is extremely valuable, 'and the steps now taken in securing its permanency are of 'the greatest importance Considerable attention is paid to the 'protection of the forest areas, especially from fire, but though the 'chapters dealing with exploitation are very full and detailed, no

‘ mention is made in either of the reports of any progress made
‘ towards gauging the permanent possibility of the forests, and it
‘ is not shown whether the exploitation is in any way systematized
‘ on the basis of either material or area Forest administration in
‘ the Jeypore and Jodhpur States is on a much smaller scale, but
‘ the progress reported seems generally speaking to be satisfac-
‘ tory As regards the Jeypore report it is extremely difficult to
‘ reconcile Forms Nos 54 and 55 from which it would appear that
‘ on 29 000 acres open to browsers 1 32 341 goats and sheep and
‘ 2,502 camels had been permitted to graze either free or on pay-
‘ ment or nearly five animals per acre, not including cattle of
‘ other descriptions ”

“Forest conservancy more or less systematically carried out is,
‘ however, by no means confined to these four States which issue
‘ printed Administration Reports There are many of the larger
‘ States such as Nahan for instance where this branch of the
‘ administration is fairly well organized In Patiala also many
‘ forest areas are systematically worked and a considerable number
‘ of the smaller States follow this example, in organizing their
‘ forest management.’

Forest Administration Reports of the Cape Colony for 1894 and 1895.

The former of these Reports has been with us for some time and now that we have received the latter we must do justice to Mr. Hutchins' kindness in sending them by giving some account of their contents To an outsider who does not know much about forest matters at the Cape of Good Hope the perusal of these reports is a little confusing Long-winded and often uninteresting as our Indian Reports may be, there is at any rate a system about them which enables the outsider to ascertain the extent of forest, reserved or otherwise, the general scope of operations and the state of affairs independently of the mere year's work, but in these Cape Reports it is most difficult to ascertain anything beyond the small details of the petty operations of the year to which they refer So far as we understand matters, however, there are four Conservations or ‘Conservancies’—(1) Western, under Mr Hutchins; (2) Midland or Knysna, apparently under Mr Heywood, (3) Eastern, under Mr Lister, and (4) Transkei, under Mr Henkel; and there is also a forest ranger in British Bechuanaland, apparently controlled by the Western Conservator Under the same officer, the Western Conservator, are the following, what we may call Divisions: (1) Tokai, (2) Uitvlugt or Cape flats, (3) Peak, (4) Table Mountain, (5) Kluitjes Kraal, (6) Worcester, (7) Clanwilliam, (8) Cedarberg, (9) Karoo; under the Midland Conservator come (1)

George, (2) Knysna, (3) Humansdorp, (4) Tzizikamma, (5) Concordia and George Plantations; under the Eastern Conservator come (1) King William's Town, (2) Keiskama Hoek, (3) Stutterheim, (4) East London and (5) Port Elizabeth; while under the Transkei Conservator come apparently (1) Tembuland, (2) East Griqualand and (3) Transkei. We may have made mistakes in this; if so, we hope Mr. Hutchins, who, we are sure, keeps still his ancient interest in the *Forester*, will set us right.

We have tried to ascertain the area of forest under each Conservator but failed; some of them however give areas in 'morgen;' thus, the Midland Conservator gives for 1895—George Division 6430 morgen, Knysna Division 18 710 morgen and Humansdorp Division 12,783 morgen, total 37,923 morgen. Perhaps some of our readers can put it into acres. It would seem that in the Western Conservancy there are no regular Reserved Forests, only plantations, and even of these it is most difficult to obtain any notion of area and conditions The Tokai plantation at the foot of Table Mountain we know to be of considerable extent, but the reports give no information; formerly it was chiefly of acacias and eucalyptus, but we are glad to see that most of the present planting work is done with cluster pine and that sowings are found easy and successful. Cluster pine is, as Mr. Hutchins shews, the best tree to plant to give the material most in demand. Mr Hutchins gives the average cost of sowings as £1-1-3 (16·7 Rs.) per acre, while he describes the cost of planting (4′ by 4 or less apparently) as varying between £3-2-6 and £4 per acre (Rs. 49 to 63), and this with a good deal of free labour. In our opinion the close-planting is perfectly right and the determination to make each piece of work a full success from the outset is even more so, and the Cape results may read a very useful lesson to those who in India advocate the 'cheap and nasty' and usually unsuccessful work of scattered plants, lines or patches and complain if the cost reaches even Rs. 30 an acre. In the year 1894 no less than 835 acres of plantation were made in the Western Circle, and the Conservator assumes 1 tree per square yard. To any body who knows what the country is like, these figures are most interesting and shew that the Cape Government is treating the subject in a statesmanlike way, undeterred by the spectre of a small present forest deficit and able to face the present work in the hopes of a splendid result in the future, with a great improvement in the scenery and probably in the climate.

The Uitvlugt or Cape Flats plantations seem to be also chiefly of cluster pine, of which regular sowings began in 1890, and have proved very successful at a cost per acre completely stocked of £2-16-4. Mr. Hutchins calculated that in 35 years mature cluster pine sleepers will be delivered on the railway at a rate of 2d. per cubic foot or 5d per sleeper.

The plantation on the Devil's Peak seems to be also a great success and Mr. Hutchins is quite jubilant over the discovery that the 'Jarrah' of Western Australia (*Eucalyptus marginata*) is the species that has given the best results so far. On Table Mountain itself work is going on well, but we wish we could find out what area has been done and what the older portions look like. Both in 1894 and 1895 a considerable amount of work was done and the chief tree reared has been, as elsewhere, the cluster pine. The planting is apparently in the catchment area for the Cape Town water supply, and as the municipality naturally desire to have title to the land, an agreement with them has been made, the conditions of which are :—

"(1) The plantations already existing on the area to be 'properly maintained and cared for by the Forest Department, at 'the sole expense of the Town Council."

"(2) The Government to have the right to extend the 'existing plantation or to form new plantations in the catchment 'area, on the pound-for-pound principle, with the Council ; such 'plantation also to remain under the control and management of 'the Forest Department."

"(3) The Government at all times to have the right of 'full and free entry by officers of the Forest Department into the 'catchment area, or any part of it, for purposes connected with 'forest work, subject to any municipal sanitary regulations."

"(4) All existing right of way to be preserved to the 'public, subject to such reasonable restrictions as may, for sanitary 'reasons, be imposed by the Council ; *i.e.*, if at any time it be 'found necessary for such sanitary reasons to close any of the 'existing paths then alternative paths to be laid out and con'structed at the expense of the Council, so that free access to the 'upper heights of the mountain may be maintained."

In the 1894 Report, Mr. Hutchins, as becomes a meteorologist, discusses at length the question of the influence of such plantations on the water-supply and comes to the conclusion that the bulk of the soil on Table Mountain being sand, the effect of forest planting will be to "cover the sandy soil with a layer of water-retaining humus." We should have preferred to say 'eventually cover" for mere planting will not at once cause the humus to form—it may take many years—and though we agree that finally it will come and the spongy layer of water-retaining soil be formed, yet at first the result may, if anything, be the other way for the roots of the trees will assist in taking out of the sand such little moisture as already exists.

Regarding the Kluitjges Kraal Plantations there is little information in the 1894 Report These plantations are away from Cape Town, near Ceres, and the area is 1437 acres of which 1050 were planted up to the end of 1894, at a cost per acre of £17-12-4 (over 280 Rs.) which is really heavy, especially as it would seem that convict labour is available and the assistance of the Royal Engineers. Now that transplants have given place to sowings the loss should be reduced. The plantation has been fenced with wire.

In the Worcester Plantation, which we belive is all *Eucalyptus globulus*, fellings were continued in 1894 but ceased in 1895. 60 acres have thus been gone over in the years 1890-1894, the receipts being £16,406 and the expenditure £13,136, giving a profit of £3,270 Mr Hutchins estimates the mean growth per acre per annum at 332½ cubic feet The original planting was done at such distances 9 × 6′ and 6′ × 6 and Mr Hutchins very properly remarks that the Nilgiri results of 752 3 cubic feet would have been more nearly reached had it been done closer, say 5 × 5. In re-planting blanks, a distance of 4 × 4′ has been largely adopted and the new plants are chiefly *Eucalyptus rostrata* It is interesting to note that the coppice regrowth at 5 years of age gives an average height of 39 feet and an average circumfurence of 14 inches The following remarks on the seasoning of blue-gum wood, shewing that at the Cape it cracks nearly as badly as it does on the Nilgiris, will be read with interest

“ As regards shrinking and warping on drying, few classes
‘ of trees bear a worse character than the Eucalypts ; and amongst
‘ them the Blue Gum is one of the worst to season Every precau-
‘ tion has been taken with the Worcester wood before despatching
‘ it to Kimberley, with, it must be confessed very poor results A
‘ considerable portion of the logs cracked so badly as to be rejected,
‘ the bulk of the wood was taken, in spite of the cracks, and no
‘ doubt answered well enough the use to which it was put—mine
‘ props. It became important in studying this evil to determine
‘ experimentally the time of the year when the timber is most free
‘ from water, *i e*, when it is least liable to crack and warp.
‘ Leaving, therefore, out of account the four summer months,
‘ November, December, January, February, I had a series of
‘ fellings instituted during the remaining eight months of the
‘ year Selecting a good straight tree of mast-like growth it was
‘ felled and the trunk cut up into five and six sections of con-
‘ venient size. Each section was then carefully measured with a
‘ tape and weighed Two years afterwards the sections where
‘ weighed again. An intermediate weighing furnished a useful
‘ check. The details of these weighings will be found appended ;
‘ the results are these ”:—

Experimental weighing of Blue Gum wood at Worcester.

DATE			Mean weight per cubic foot Green		Mean weight per cubic foot 2 years seasoned
March 23rd	1893	...	69 84	...	51·63
April 1st	,,	..	67 52	..	46·17
May 1st	,,		64·60	.	43 65
June 7th	,,	...	64 63	...	47 22
July 3rd	,,	...	68 54	...	49 12
August 4th	,,	..	69 78	...	52 12 (*a*)
September 1st	,,	...	71 81	...	56 83 (*a*)
October 3rd	,,	..	69 45	...	48·07

"From the above it is to be concluded that Blue Gum wood 'contains least water, *i e*, is lightest during May and June These 'months would therefore appear to be the best at Worcester for 'felling the Blue Gum Wood which weighed 64lbs a cubic 'foot in May and June weighed nearly 72lbs a cubic foot in 'September during the spring of the year, the most active period 'of vegetation"

The Clanwilliam plantation is small, only 31 acres, it contains trees of various kinds, chiefly Cluster Pine and *Pinus insignis*, and the Kabyl Ash (a variety of *Fraxinus excelsa*) is said to have been very successful

The Cedarberg forests are natural forests of cedar (*Callitris arborea*) which are thus described

"In May last I visited the greater portion of the Cedar 'forests They represent an area of about 60 square miles sparsely 'dotted over with the cedar tree It is evident that fire is the 'controlling agent in the distribution and multiplication of these 'interesting trees, and that the forest remaining is mainly that 'situated on ground so stony and bare that little other vegetation 'grows, and where consequently there is nothing to burn It 'seems probable that the forest formerly consisted of two 'classes —'

(1) The best—Dense and uninflammable filling fertile valleys

(2) The inferior Scattered and open on almost bare rock where there is no inflammable vegetation —

"Of the first only vestiges remain at this day"

'The policy to be pursued for the conservation and extension 'of the valuable Cedar tree appears to be dense fire-proof planta'tions of Cedar mixed with partial shade bearers, such as Black'wood (*Acacia melanoxylon*) or even the Common Oak (*Quercus 'pedunculata*) which is to some extent a shade-bearer in South 'Africa Both Oak and Blackwood grow freely in the fertile, well'watered valleys of the Cedarberg the Oak with better boles than 'in the Cape Peninsula Proposals are now in progress for the 'demarcation of the Cedarberg Forests and I have in next year's 'estimates an item of £400 for a fireproof plantation as sketched 'above The value of the Cedarwood has been repeatedly refer'red to in forest and other reports"

It may be hoped that these natural forests may soon be properly demarcated, and protected from fire

The plantation on the Karoo consists of about 200 acres near Hanover and 50 acres at Carnarvon but work is at a standstill owing to some difficulties about title to the ground Before passing on to the Midland Circle we may note that a good deal of work seems to be done in and about Cape Town, as the Conservator has charge of the tree-planting work Mr Hutchins very rightly advocates the use of wood-paving in the streets and says as follows :—

" Wood Paving. The *Timber Trade*, the *Forest* and other
‘ technical magazines contain frequent allusions to the increasing
‘ use of wood paving, more especially hardwood paving in England.
‘ Heaps of suitable hardwood lie rotting round every saw-mill at
‘ Knysna, but the ponderous steam roller continues to grind the
‘ unsuitable macadam into Cape Town streets—macadam that is
‘ mud in winter and dust in summer only partially controlled by
costly watering with objectionable salt water. When there is a
flood it washes away and then comes more dust, more steam
‘ roller and more expense to replace it. The streets continue
‘ noisy, dirty, costly and uncomfortable. It is not my business to
‘ complain of this, but of the reckless wastes of our wood, that
‘ will never again be so cheap as it now is. I can only once more
‘ protest as I have done for many years past. The present cheap
‘ wood from Knysna will come to an end with the first cutting
‘ over of the primeval forest.’

It is also worth while to quote here an analysis of crude turpentine from the Stone-pine plantations at Tokai, made by the Government Analyst Mr. Van der Riet.

" Report on the analysis of a sample of Crude Turpentine,
‘ submitted by the Conservator of Forests, under cover of his letter
‘ No. D 351—94, dated 7th December 1894."

" The Crude Turpentine which was contained in two separate
‘ tins and amounted in all to 37 lbs. had a syrupy consistence,
‘ pleasant resinous odour and was of a light brown colour.’

"A pound weight of the mixed material was warmed in a tabu-
‘ lated glass retort (by means of an oil bath) up to 100°—110°C,
‘ when a little water distilled over mixed with essential oil. The
‘ temperature of the oil bath was then raised to 130°—140°C. and
‘ a current of steam passed through the molten contents of the
‘ retort by means of a tube reaching to the bottom. This was
‘ continued till all essential oil had passed over with steam into
‘ the condenser."

‘ The molten residue in the retort (freed from dark-coloured
‘ impurities, such as fragments of bark which had sunk to the
‘ bottom) was poured into cold water and rapidly solidified to a
‘ light yellow resin.

‘ The distillate on the other hand, was shaken up with Caus-
‘ tic Soda (to remove acid impurities) and the layer of purified oil
‘ removed and dried over fused Calcic Chloride. The oil thus got
‘ was clear and colourless and had a fragrant odour resembling that
‘ of a mixture of spirits of turpentine with essence of lemon. It
‘ amounted in quantity to about 8 % by weight of the Crude Tur-
‘ pentine.’

" Regarding the commercial value of the products thus
‘ obtained—samples of which I am supplying to the Conservator
‘ of Forests. I believe that the resin—forming almost 90 % of the
‘ Crude Turpentine—would be of practical value in the manufac-
‘ ture of soap, for which it is particularly adapted on account of its
‘ light colour."

"The essential oil obtained as a by-product could be sold 'and used as spirits of turpentine"

The same analyst has also been determining the amount of tannin in various barks with the result that *Acacia saligna* the best kind gave about 64 per cent of total extract as tannin

The Knysna forests, forming three Divisions of the Midland Conservancy are natural forests which are under working for the supply of timber chiefly to the Railways They yield about 300 000 cubic feet yearly taken from sections or coupes marked by two Forest officers and the following is Mr Heywood's account of the work —

"In forests of this description all trees over a certain diameter varying with species are now marked for felling in sections, care being taken to avoid making too serious gaps in the canopy, and to observe sylvicultural rules generally If the diameter standard system be a desirable one and the section properly marked, not one of these trees should be left standing But the returns 'abundantly show that it is the wood-cutter who makes the final selection and in his action or inaction the cultural management 'of the forests virtually rests And this is the weakest point in 'the individual license system I am quite aware that nothing 'new is contained in these views and that efforts have been made 'to introduce other methods Strong prejudices have to be com'batted and the maintenance of a large population considered"

Mr Heywood and his Assistant Mr McNaughton discuss, in the 1895 Report, the situation at length, but no regular scheme for improved forestry seems to have been determined on The Knysna forests are we believe the finest natural forests in the colony and in our opinion they deserve to have the most careful attention paid them in order to ensure their being properly worked under really good sylvicultural principles

The difficulty, however, seems to be the same one that has usually presented itself in India, when what may perhaps be best called *virgin* forests come under working for the first time and the reproduction has to be assured on areas where the crop is in anything but an ideal condition for it The detailed opinions of the Assistant Conservator, Mr McNaughton (Coopers Hill man) are too long for reprint here but his final conclusions may usefully be given We should hope that the result will be the speedy preparation of the working plan, which ought not to be too elaborate

"For all I would hold that the present first cutting should be 'an improvement thinning, and that all trees marked for the axe 'should be marked on a sylvicultural basis save perhaps, small 'outlying patches of forests in comparatively inaccessible places, 'which are doomed to extinction and which might be converted 'into revenue as soon as possible This cutting should not be a 'commercial sweep In the most valuable class of forests, cultural 'operations, which are of necessity expensive, might be introduc-'ed. First the marking for the axe would have to be most care-'fully done, under supervision of a superior officer who 'would be responsible. After the section is closed it should be 'gone over, the balance of the marked trees removed or ringed 'thoroughly, stinkwood and other stools prepared, creepers cut, 'valuable saplings or poles freed where the canopy is not interrupt-'ed by such operation. Artificial regeneration, by sowing in the 'larger blanks or planting in the smaller, would also be necessary 'though the respective merits of sowing or planting have yet to be 'considered as well as the advisability of introducing exotics. 'These areas would require periodical attention After the lapse 'of some fixed period the whole area would have again to be re-'visited, stool shoots thinned, valuable young saplings or poles again 'lightly freed, creepers again cut, etc, sowings and plantations 'would require doubtless constant attention until sufficiently 'advanced to no longer require it. A third operation at the end 'of another period would also be necessary This would be of the 'character of a light thinning. It must be understood these opera-'tions carry with them no immediate returns, their value depend-'ent on the improvement to the growing stock In the second 'class of forests a removal of the balance of the marked 'timber, preparation of the stools and a light freeing of 'valuable young trees after the section was closed, that would 'perhaps be all the expenditure that would be warranted with 'possibly a little attention later on. The poorer class of forests 'would, I am afraid, perhaps only justify expenditure to the extent 'of the removal of the marked but unfelled trees. These opera-'tions would rquire some sylvicultural knowledge of the species 'treated, a careful consideration of the objects of management, and 'above all a definite working plan, without which a uniform 'scheme of treatment so essential to any satisfactory result is 'practically an impossibility."

In the Tzizikamma forests, Mr Tothill, the District Forest Officer, says in his 1895 Report cultivation is extending under licenses. We do not understand this arrangement quite, but it seems as if the idea is by giving cultivation licenses for burnt forest land to induce woodcutters to settle and assist in the exploitation of the timber forests, and the protection of the best of them from fire.

We have in vain tried to elicit from the Reports some definite notion of the extent and conditions of the forests in the Eastern Conservancy. Being written presumably for the perusal of those who know those forests, the Reports merely give brief accounts of the year's operations, and, except the plantation work, there is little or nothing for us to note specially. The Fort Cunninghame plantations seem to be very interesting; they are chiefly of *Eucalyptus* of various species, and, as also happened in the Nilgiris, the names had been so lost sight of, that specimens had to be collected and sent to Australia where they were identified by the late Baron von Mueller. At Port Elizabeth, an important work is going on in the reclamation of drift sands with the assistance, as at Cape Town, of town refuse. Tamarisk cuttings are largely planted to form nurses, and the chief trees grown are *Acacia saligna*, *Casuarina quadrivalvis*, *Cupressus macrocarpa* and *Pinus halepensis*.

In the Transkei Conservancy much damage was done during 1895 by locusts, and in the previous year by drought. Demarcation was started after a visit from the Right Honorable the Prime Minister, Mr. Cecil Rhodes, who decided that the larger and best forests should be demarcated and placed under the absolute control of the Forest Department while smaller patches of forest and scrub would be made over to the natives for their use subject to the District Magistrates' orders. The following remarks of the Conservator, Mr. Henkel, will explain more fully the position:—

> "The selection and demarcation of the Transkeian forests, which are to come under the entire control of the Forest Department has made great progress during the year under report and only those in three Magisterial districts remain to be finished. All forests not demarcated come under the supervision of the Resident Magistrates and will be held in trust for the natives. *Under the entire control of the Forest Department* means that no *free permits* will henceforth be issued by the Resident Magistrates to natives for major and minor forest produce, nor permits for hunting by natives, etc. How far these divisions of the wooded areas in the Transkeian territories, and the establishment of dual control over them will affect the conservation of them, remains to be seen. It is perfectly certain that very little revenue will accrue from the Crown or Demarcated Forests, until the forests placed under the Magistrates are entirely cut out which will probably be in 5 years' time. As long as natives are allowed to roam at liberty over and depasture their stock in any forest, whether under the Magistrates or under the Forest Department, no regrowth will attain any height; the larger trees will naturally decay and become windfalls, and eventually these forests will disappear altogether."

The demarcated reserves are being fenced with wire, as this has been found to be the only means of regulating the grazing. The Conservator complains in his account of the forest offences in 1895, that the accused is often put into the witness box by the Magistrate on the bench. He says:—

> "Another serious drawback is that the accused is often put into the witness box by the Magistrate upon the bench, and his statement taken down. Of course, being ignorant of the nature of an oath, he will swear the very opposite to what the witnesses to the theft committed state, and bring any amount of his friends to state the same. In very many cases native offenders when caught stealing timber and prosecuted, will employ a law agent,

‘who will browbeat the foresters and guards until they become confused, and the case be lost in consequence. The same happens with the Cape Police when prosecuting for sheep-stealing.”

The last report in each of these bulky books is that of British Bechuanaland, but there is nothing in either of them of any interest. They are simply the running diaries of the Forest Ranger written on his tours of inspection.

There is no doubt that some most important work is being done at the Cape, especially in the plantations, and that these latter will some day be most valuable and useful, just as their splendid and important nurseries are in the present; but it seems as if some central head authority is required to prescribe work on a definite plan, and we certainly think that if Parliament requires such long Annual Reports there should be a definite arrangement for them which would enable the reader to understand better the position of affairs. We believe that formerly the Superintendent, Count Vasselot de Regne, now Conservateur des Forêts in one of the Circles of Algeria, had the head control of all the circles, and gave each year a general summary of work. It would seem as if, with his retirement, the post had been abolished, and we were under the impression that Mr. Hutchins had some general supervision, but from these Reports it would hardly seem as if such were the case.

VI.—EXTRACTS, NOTES & QUERIES

Forest Reservation in the United States.

As we go to Press the announcement is made that President Cleveland has set apart by proclamation thirteen new forest reserves, including altogether an area of more than twenty-one million acres. This added to the reservations previously established by Presidents Harrison and Cleveland increases the total area of reserved forest land in the Western States and territories to about thirty-nine million acres; that is, the combined area of these reservations exclusive of the National Parks, is as great as that of the States of Maine, New Hampshire, Vermont, Massachusetts and Rhode Island. The new reserves include all the central portion of the Black Hills of South Dakota, the Big Horn Mountain Range in Wyoming, the Jackson Lake country south of the Yellowstone National Park in Wyoming, all the Rocky Mountains of Northern Montana, a valuable forest region in Northern Idaho, the principal part of the Bitter Root Mountain region in Montana and Idaho, the Cascade Mountains of Northern and of Southern Washington, the Sierra summits of California north of the Yosemite National Park, the San Jacinta Mountains in Southern California, and the

Uintah Mountains in Northern Utah. The location and boundaries of these forest lands have been carefully studied by the Commission appointed by the National Academy of Sciences, who have made it their aim to include as much as possible of the great bodies of timber that are left on unentered land, and wherever it was practicable to secure the continued existence of the forests on high mountain slopes which protect the sources of streams most useful for irrigation and navigation. Much remains to be done before this magnificent domain is rendered safe from spoliation, but the simple act of setting these forest lands apart is enough to justify the creation of the Commission. In our next issue we shall publish with some fullness of detail a description of the reservations, and we only add here that it may be doubted whether any Act of President Cleveland's administration will have such a beneficient and far-reaching influence upon the welfare of the country as this series of proclamations. The country is to be congratulated on having a Chief Magistrate who is capable of taking such a broad and statesmanlike view, and the people will be grateful to him for the promptness and decision with which he has acted.—*Garden and Forest.*

Indian Timbers for Fishing Rods.

We publish below the abstract of a paper, reprinted from the *Fishing Gazette* on woods at present used for making fishing rods, and on some Indian timbers which might be used as substitutes for these by Surgeon-General G. Bidie, C.I.E., F.Z.S., &c.—

Everyone knows how largely the serviceable qualities of a fishing rod depend on the kind of wood of which it is made, and it is the subject of the above paper to notice briefly the more important woods at present used by rod makers and to introduce to notice some Indian timbers which may prove as good as, or even better than, those at present employed. To produce high-class rods, the wood must not only have special natural qualities, but these must, so to speak, be brought out and fixed by long and careful seasoning; moreover, the same log will yield from different sections, materials of very different value, a fact which necessitates careful testing and the rejection of many inferior pieces. The woods most used at the present time in rod-making are, greenheart, washaba blue mahoe, lancewood, hickory, ash, snakewood, and canes. Of all these, putting aside the canes, the chief favourite is:—

Greenheart, obtained from a laurel, *Nectandra Rodioei*, the Bibiri tree of British Guiana, which attains a height of 60 to 70 ft. The timber is chiefly used for making piles, and in shipbuilding. It is a heavy wood, having a specific gravity of 1, but no wood at present in use will furnish a more elegant and serviceable rod

Washaba, which also comes from British Guiana, is very like greenheart, but is heavier and more difficult to work

Mahoe —There are several trees to which this name is applied, found in various parts of the tropics Chiefly used in this country for rod-making is the Blue Mahoe (*Paritium elatum*) of Cuba and Jamaica, a very light strong and resilient wood Its elasticity accounts for its being used in Cuba for springs for a two-wheeled cart called a "Volante" The wood of the Indian Seaside Mahoe or tulip tree (*Thespesia populnea*) is worth a trial by rod makers

Lancewood, which occurs in Guiana and Cuba, is a wood easily worked light and elastic and is used a good deal by carriage builders Being less heavy than greenheart, it is preferred by some makers for tops for fly rods

Hickory (the American *Careya alba*) ash (*Fraxinus excelsior*), and snakewood (*Brosimum aubletii*) are less extensively used in this county for rod-making

The canes chiefly used in the rod industry are East Indian mottled, Spanish white, South Carolina and Japanese , also the ordinary male and female bamboo

In bringing to notice Indian woods likely to make serviceable rods, the difficulty is to make a selection as the forest flora of India is very rich in valuable timber of which but very few are known and utilised either locally in the East or in the European markets

Trincomallee wood (*Berrya Ammonilla*) is the wood used in Madras for making the large *masoola* or surf boats where its strength elasticity and toughness while bumping violently in a heavy surf are tested in a way that hardly any other timber would endure Taking all its good qualities into consideration, Trincomallee wood seems likely to prove a good rod making material, and it could be got without difficulty from either Ceylon or Madras

Parrotia Jacquemontiana is widely distributed at considerable elevations on the slopes of the North-West Himalayas It is of small size, and for toughness and elasticity its wood surpasses that of almost any other tree with which we are at present acquainted Its twigs are employed in making the thick ropes used in the construction of the suspension bridges, by which streams and ravines on the hills of Northern India are crossed

Other Indian timbers which would undoubtedly prove excellent material for rod-making are —*Grewia oppositifolia*, found in the North-West Himalayas *Grewia tilifolia*, widely distributed over Northern and Southern India and used for carriage shafts, oars masts &c *Grewia vestita*, found in Northern and Central India, and in Burma (a strong and supple wood, clean and straight in the grain) and *Heritiera littoralis*, widely distributed along the coasts of Northern India and on the shore of Burma, and the Andaman Islands. The latter is largely used in Calcutta and is altogether a promising wood for it could be easily obtained from Calcutta where it is sold under the name of Sundri.

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* Or Burma —*Hon. Ed*

Ougeinia dalbergioides, *Dalbergia sissoo*, *Artocapus fraxinifolius*, *Hardwickia binata*, *Acacia catechu*, *Lagerstrœmia tomentosa*, *Gmelina arborea*, *Areca catechu*, *Caryota urens*, the cocoanut palm (*Cocos nucifera*) and the Palmyra palm (*Borassus flabelliformis*), all widely distributed throughout India and yielding valuable timbers, and all mentioned, is well deserving of trial by rod makers.—*Timber Trades Journal.*

Indian Woods for Matches

The Conservator of Forests, Bengal, lately brought to notice that he had been in correspondence with the Bengal Safety Match Manufacturing Company regarding the most suitable kinds of wood for match making. After extended experiments the following kinds of wood were considered by the Company to be suitable for match making:—

Elæocarpus robustus
Evodia fraxinifolia
Abies Webbiana
Juniperus recurva
Alnus Nepalensis
Magnolia Campbellii
Heptapleurum elatum
Sambucus javanica
Symplocos lucida
Do. ramosissima
Gmelina arborea
Excœcaria Agallocha

At present the Company is using *Excœcaria Agallocha* exclusively and they are able to obtain this wood delivered in Calcutta from the Sunderbans Forests at 3 annas a maund and they use some 3000 maunds of it a month. The wood of *Ecœcaria Agallocha* is fairly well suited for the purpose and the matches made from it, selling in Calcutta at a wholesale price of 11 annas per gross, are at least as good as the Japanese matches which at present flood the Calcutta market. They ignite easily and are not much affected by damp, but they have the serious defect of glowing for some time after they have been extinguished.

It has been ascertained from Conservators in the various Provinces, that of the other woods mentioned above the following only are available in any quantity and in such localities as to permit their being delivered at a Railway station at reasonable prices —

Kind of timber	Price	Circle	Place where the timber could be delivered	Price
				Rs As P
Abies Webbiana	N W P	School	Jagadri N W R	0 5 0 per c ft
Do do Also Abies Sunthiana	Panjab	Panjal	Jhelum Wazirabad Lahore Bias Darila	0 3 0 to 0 5 0
Gmelina arborea	U Burma	Western	Rangoon	15 0 0 a ton
Do do	L Burma	Pegu	Rangoon	6 0 0 to 12 0 0 a ton

Limited quantities of *Gmelina arborea* might also be delivered at Mandalay at Rs 3-2 a ton exclusive of royalty

Other woods which have been suggested as suitable for the manufacture of matches are—

Acrocarpus fraxinifolius Artocarpus integrifolia Bignonia indica, *Grewia hirsuta Bombax Malabaricum Nauclea cordifolia*, *Tetrameles nudiflora* [illegible] *Boswellia thurifera*, *Populus ciliata* and *Pinus Khasya* but whether any of these can be successfully used commercially is a question which needs further investigation

Prize Day at the Imperial Forest School, Dehra Dun.

The close of the seventh course of training in forestry at the above Imperial School was celebrated within the lovely grounds of that Institution on the 31st March in a large tent pitched in a suitable spot in front of the main building In the building itself were spread out for inspection specimens of the maps and plans executed by the students themselves, and many remarks were heard of astonishment and approval on the art and patience thereon displayed. The ceremony itself began at 4-30 P M, when Mr Ribbentrop, C I E, Inspector-General of Forests, accompanied by Mr Oliver, Conservator of the School Circle and Director of the Forest School, Mr Wilmot, Conservator of Forests Oudh Circle, Mr Fernandez, officiating Conservator of Forests Central Provinces, Mr Nisbet, officiating Conservator of Forests of one of the Burma Circles, Mr. Bryant, Assistant Inspector-General, and the staff of the school, mounted the dais of the large tent

The function was supported by many residents of Dehra Dun and the neighbourhood, including Civil officers, headed by Mr, Giles, C S, Superintendent of the Dun.

Mr Oliver, the Director of the School, then addressed the students and guests as follows —

"You have been asked here to assist at the annual distribution of certificates and prizes to the successful students of the Forest School and it falls to my lot to give you a short account of the year's work As most of you are aware there have been considerable changes in the school staff Mr Gamble to whom the school is chiefly indebted for its present organisation, left in August last on long leave The post of Deputy-Director, vacated by Mr Smythies at the beginning of the year has since been ably filled by Mr Gleadow Mr Gradon has been away during the greater part of the year and Mr Osmaston who acted for him, was, before Mr Gradon's return compelled by ill-health to go on three months leave Mr Rogers whose absence you will all regret, completely broke down in health towards the close of the year, and has since been replaced by Mr Osmaston Mr Grenfell has also been invalided home and Mr Collins the Assistant Agricultural Chemist is at present I am sorry to say, laid up with typhoid fever

The health of the students also has not been good I regret to have to record the death from typhoid fever of Student Leoun after a short illness With the exception however, of one mild case of cholera there was no other illness of a serious nature, though there was a good deal of sickness during the rains, the average number of students incapacitated from attending lectures being as high as 4 per cent during the three months August to October You will see from this that the season has been an unhealthy one and if it had not been for the careful supervison of Surgeon-Major Emerson and the attention of the Hospital Assistant Babu Ganga Sahai matters would no doubt have been a good deal worse

The results of the examinations just concluded are better than those of last year Of the 21 students in the upper class all have gained Ranger's certificates (one with honours) and in the lower class 8 out of 9 have been granted Forester's certificates At the same time the average number of marks has been higher throughout In regard to medals and prizes the Board of Control has made the following awards —A silver medal to Ganshyam Prasad, who was first in Forestry, Forest Engineering Mathematics Physical Science and Forest Law, and equal first in Surveying and Drawing Bronze medals have been granted as follows —

Sylviculture—W G Slaney and Chutur Bhuj
Surveying and Drawing—W G Slaney
Botany—Basanta Kunwar Goswami
Physical Science—S V Venkataramana Iyer
Zoology—W P G Cooper
Forestry and General Proficiency (lower class)—Nurulla Khan

The Campbell Walker prize for the best in Forestry of the Madras students has been gained by S V Venkataramana Iyer

Mr Moir's prize for the best practical forester in the upper class goes to R de Courcy

A prize for the best general note book presented by Mr Hill, has been awarded to V R Venkataramiah

The officiating Director's prize for the best Forest Engineering note book to A Pacheco

Mr Gamble's prize for the best herbarium to Lalit Mohun Sen.

Mr Gamble's prize for the best Entomological Collection to W. P G Cooper

The officiating Director's prize for the best practical forester in the lower class to Kanya Lall

The note books of E A Radcliffe and Y M Vadikar have been commended by the examiners as well as the herbariums of Juanada Charan Sen Basunta Kumar Goswami, W P G Cooper and V R Venkataramiah

No award has been made from the Brandis prize fund

The school athletic sports were held on the 9th and 10th of October ; Fouracres and Luchman Singh carrying off most of the prizes

The European and Eurasian students have as usual served in the Volunteers and our best thanks are due to the officers of the Debra Dun Mounted Rifles to Lieutenant Wylie the Adjutant, and to Sergeant-Major Allen for the interest they have taken in this part of the school's work

We are also indebted to Colonel Begbie and Captain Judge for lending havildars to drill the native students The thanks of the school staff are further due to Messrs Reynolds, Duthie and Finn, for the help they have afforded in the examinations

It now only remains for me to wish you students who are about to leave us every success in your future careers, and to thank you ladies and gentlemen, for the kindly interest you have shown in the school by your presence here this day "

On the conclusion of Mr Oliver's speech Mrs Gradon, at the request of Mr Ribbentrop, distributed the medals and prizes to the successful students, saying a few appropriate words to each as she did so. The prizes were substantial and useful and amongst them were noticed a microscope, a writing case, a despatch box, and a pair of binoculars

After the distribution of the prizes the certificates (Rangers' and Foresters') were given out by Mr Ribbentrop with the help of Mr Bryant Mr Oliver calling up the students one by one When the applause that this part of the ceremony created had subsided, Mr. Ribbentrop addressed the students and guests in the following words .—

" Ladies and gentlemen, brother officers and students of the Forest School,—Considerable changes have taken place in the constitution of the staff of this College since last I had the honour of attending the closure of the school course as a guest It was under these circumstances natural that I should feel some anxiety in regard to the continuity of the high character of teaching for which this institution has been known for years past I knew that the officers selected to fill the places of those who for a long time had been the mainstay of the success of this school were men of considerable knowledge and special abilities I had great confidence in them, but as the officers had been selected by me, and as some of them were more or less new to the work I felt as if I was burdened with more than my usual share of the responsibility of the results of the year's teaching

I felt no rest till I had visited this school in autumn last and convinced myself by personal observation that the teaching was thoroughly maintained and that the instructions were as practical as circumstances would permit I felt better after that visit in November last and started on my tours to Assam and Burma with a light heart Nevertheless when I passed the Mohan pass a few days ago on a dark inhospitable and cloudy night all my misgivings returned I dare say that to some extent these gloomy forebodings were due to external circumstances for owing to disconnection of trains at Ghaziabad, an occurrence from which you Dehra Dunites seem to suffer more or less chronically, it was past the usual dinner hour long before I reached the tunnel, and I was very hungry But however this may be I might have spared myself all and every anxiety, for when I attended the examination in Forestry during the next morning I became at once convinced that the average knowledge exhibited by the students in this the most important branch in our course of instruction—showed if anything an advance on the result of previous years' examinations. In some few cases we permitted ourselves to examine beyond the usual standard demanded and I am glad to say found a substratum of real solid knowledge I was much pleased with this, especially as visits to other class rooms and inquiries showed that the examinations in other subjects were proceeding satisfactorily. My friend Mr Oliver, the Director has already told you that the present is the first year during which all students of the upper class have obtained the Rangers certificates I can assure you that these certificates were awarded without any undue use of the Board's prerogative of awarding a few "grace marks" in systematic botany and other auxiliary sciences In no case was a single grace mark required in Forestry the total number of grace marks awarded was less than usual, and it is satisfactory to me that in no single instance was I called upon for a casting vote The tail of the year was thus rather stronger than usual, but as is frequently the case with "tails," it showed a considerable tapering off in comparison to the body, and in justice to the better students I think it necessary to mention that there is a sudden drop of upwards of 120 marks between numbers 19 and 20 on the published list.

You have already heard that we have the pleasure of greeting a man of "honours," but what to my mind is even more satisfactory is that the students have obtained upwards of 66 per cent. of the total marks obtainable, and that 19 of the 24 candidates have passed with upwards of 120 marks in hand.

The results of the examinations were almost equally good in the vernacular class. There was no necessity of considering the question of grace marks at all; those who have obtained a certificate, passed fair and square But it grieves me to say that one of the students in this class failed beyond the possibility of any relief within the Board's discretion. I have now, I think, sung sufficient praise, and you passed students will perhaps permit me (if only for the benefit of those who follow behind you) to point out some little weakness from which even the best of you suffer to a greater or less extent This weakness was specially evident in your answers in Applied Mathematics. I grant that some of the questions were a little involved, but all of them were easy. Where you failed was in trying to answer questions before you had sufficiently logically analysed them. My suspicions having been aroused by the answers in mathematics I gave some of you the treat of a little private examination, the result of which confirmed me in the correctness of my surmise. I asked one of the best of you, "If a goose weighs seven pounds and half his own weight, what does the goose weigh?" And he failed to translate this simple question into algebra without the help of paper. Of course, if I had asked any of you:—"If $7 + \frac{1}{2}x = x$ what's the value of x?" your answer would have come in a chorus, and many of you would have been insulted at the simplicity of the question.

On questioning some of you, I found you were perfectly conversant in the use of π, but ignorant how π was developed and prepared. Trigonometrical and other formula also if you know at all, you simply know by sheer force of memory, and such knowledge does not always last, and I pray you will as far as possible substitute the acquirements of knowledge by reason instead of learning it by heart. If any of you passed students feel aggrieved by what I have said, or think that I have in any way been unjust, I shall be very glad to put you (as far as my time permits) through a little course of private examination. I only hope that you will not all speak at once! Well! as none of you seem particularly hot or eager to continue your examinations, I have only to bid you a "farewell" from the school where you have passed the last two years, and where I hope you have been happy and content. You carry away with you a more or less considerable amount of theoretical and practical knowledge, but pray do not for this reason run away with the idea that you are "finished foresters." All we can hope and expect is, that the fruit may have set in this respect, and that it will expand and ripen in the fostering sunlight of experience. I am glad to see that some of you at least fully acknowledge the necessity of continual observation and experience. I find in one of your note books "a zealous forester must take everything in with his eye, and should not believe what he finds printed in books." Well, I am sorry I cannot go quite this length, but nevertheless the pith of what I want to say lies within these words, "Observe constantly and carefully, analyse minutely and logically, and base your own deductions on such analyses" But pray do not neglect what you have learnt from books, nor the knowledge imparted to you by your professors and teachers, even though you had to take it in by the ear and not by the eye. You are now entering a practical career of life, I am afraid that for some of you experience will have some disappointments in store. I was shown a letter to-day in which the words, "Excessive hardships and exposure of jungle life" had been applied to the personally conducted tours in the Jaunsar hills and the school picnics in the Dun Forests. I can only wish that all of you will overcome such disappointments with energy and pluck, and will turn out good foresters and valuable servants to the State. I wish you a successful career.

Mr. Oliver, Professors and Instructors, I congratulate you on the success of this year's work. The foundation of the instruction of the men we passed out just now was however laid by those who preceeded you, and you must yield to them a considerable share of the credit due to the school. Ladies and gentlemen, I beg to acknowledge most gratefully the honour you confer upon us by your presence, and to tell you how highly we appreciate the continuous interest which you take in the welfare of our College, which, so to say, has grown up in your midst. Ladies and gentlemen, I thank you."

Mr. Oliver then in a few words closed the function, and the guests dispersed, some to the refreshments spread out on the spacious lawn, and some to see the maps and plans drawn by the retiring students.

Thus came to an end a very pleasant afternoon.—*Pioneer.*

VII-TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

3rd March, 1897

EAST INDIA TEAK.—The delivery during February has been 2,145 loads against 2,236 loads in the same month last year. For the two months of this year they amount to 3,922 loads compared with 4,443 loads in this period of 1896. Prices for floating cargoes which are scarce have risen again in February and the outside demand is so good as to be rather starving the London market. Prices here have been rather firmer accordingly.

ROSEWOOD.—EAST INDIA.—Good wood is wanted, and small parcels would sell well.

SATINWOOD.—EAST INDIA.—There has been rather more enquiry especially for figury *logs* or *boards* but for plainwood there is very little demand.

EBONY.—EAST INDIA.—Small lots of good logs would find ready buyers.

PRICE CURRENT.

Indian teak	per load	£11 10s	to	£16 10s
Rosewood	,, ton	£8	to	£10
Satinwood	,, sup. foot	8d	to	12d
Ebony	,, ton	£7	to	£8

MARKET RATES OF PRODUCE

Tropical Agriculturist, March, 1897

Cardamoms		per lb	3s 1d	to	3s 2d
Croton seeds		per cwt	80s	to	82s.
Cutch		,,	9s 3d	to	32s. 6d.
Gum Arabic, Madras		,,	37s 6d	to	45s
Gum Kino		,,	£45	to	£55
Indiarubber,	Assam	per lb	1s 10d	to	2s 4d.
,,	Burma	,,	1s 4d	to	2s 1d
Myrabolams,	Madras	per cwt	3s 9d	to	5s 6d
,,	Bombay	,,	4s 3d	to	8s 6d
,,	Jubbulpore	,,	5s	to	7s.
,,	Calcutta	,,	4s	to	6s.
Nux Vomica, Madras		,,	6s	to	7s. 6d.
Oil, Lemon Grass		per lb	2⅝d		
Orchella, Ceylon		per ton	10s	to	12s 6d.
Sandalwood, logs			£30	to	£50
,,	chips	,,	£4	to	£8
Sapanwood,		,,	£4-10s	to	£5-15s.
Seed lac		,,	70s	to	80s.
Tamarinds		,,	6s.	to	7s.

Teak Circular.

Messrs Denny, Mott and Dickson report : Deliveries from the docks in London last month were 2 119 loads as against 2,640 loads for the corresponding month of last year The landings were insignificant, consisting of 139 loads of logs and 89 loads of planks The dock stocks are unusually moderate, consisting of —

		1897 Loads	1896. Loads.
Logs		7,301	8 922
Planks		1,233	2,737
Blocks		90	81
	Total	8,624	11,740

Floating cargoes of teak have continued in good demand at constantly advancing prices The demand from the Continent for naval construction tends to make shippers confident that such an outlet will be provided for the likely supplies of teak to come to hand as to make them independent of the strength of the ordinary commercial demand They should however remember that such commercial demand is the backbone of the teak market in ordinary times, and not be tempted to encourage those directing the important shipbuilding and rolling stock industries to search for substitutes for teak, because of the strength of an exceptional position being unduly taken advantage of by shippers At present, prices are only dear in comparison with the unhealthily low prices of a very depressed period , but in their haste to recoup former losses, shippers and importers should remember when they point to teak having often been worth above £15 per load in the market, that Burmah wood at least used to come over of better quality, conversion, and dimensions than is now the case, and this falling-away in quality, if combined with high prices will strongly conduce to the seeking for cheaper substitutes by dissatisfied buyers Good general trade has enabled consumers to cheerfully pay advanced prices for teak, as for other material for construction ; but merchants and dealers on this side feel that shippers would do well to remain content with present rates rather than to wring the fullest advantage from the exceptional naval demand which the political position abroad has naturally served to intensify —*Timber Trades Journal.*

ERRATA

APRIL 1897

p 121 line 20 *for* 'A'Arcy' *read* 'D'Arcy'
p 122 10 *for* 'generelly' *read* 'generally'
p 124 „ 4 from below, *for* 'meet' *read* 'Forest'
p 128 „ 10 from below, *after* 'tracts' *add* ','
p. 131 „ 22 *for* '*Iambusa*' read '*Bambusa*'
p 140 „ 8 from below for 'Kluitjges' *read* 'Kluitjes'
p 144 „ 10 for 'Heyword' *read* 'Heywood'
p. 146 „ 8 for 'Nauskei' *read* 'Transkei'
p 149 „ 17 for 'Careva' *read* 'Carya'
„ „ 5 from below, *for* 'tilifolia' *read* 'tiliæfolia'
p 151 in Schedule *for* 'Sunthiana' *read* 'Smithiana'

THE

INDIAN FORESTER.

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The cultivation of Teak in the Dutch Netherlands.

Abridged translation of an article by R Seubert in the "Forst- und Jagd-Zeitung"

The Dutch Government possesses in its Java Forests, a most valuable property which for many years past it has been doing its best to improve

The forests of Java and Madura, (an island under the administration of Java) are officially divided into two main classes, teak and jungle wood forests The former are all under regulated management but of the latter only those at high elevations, which are important from a climatic point of view, are subject to rules which are not very strictly enforced

Teak locally called Djati, is found both in Java and Madura and in a few of the islands further east In the rest of the Archipelago especially Sumatra repeated attempts to acclimatize teak have yielded no satisfactory results and it may be taken for granted that the failure of the tree in these parts shows that the climate is unsuited to it, and that future attempts to introduce it will be equally unsuccessful In Java also endeavours have been made to grow teak outside its natural habitat, both towards the west and at higher elevations, but here again it has been found that in the absence of certain necessary conditions of soil and climate it is useless to expect any favourable results

Although there is is no prospect of teak being extended beyond its natural home, its cultivation within its proper limits is very easy, provided the conditions are favourable, as it grows rapidly and after a short time requires no further attention

Before going on to describe the present methods of cultivation it is necessary to mention the endeavours which have been made to reproduce the teak tree by natural means There has been no lack of such attempts and although occasionally good results have been obtained, in most cases they have ended in failure. It is true that in Java a secondary growth is found wherever the original virgin forest has been removed, but such growth generally consists of coppice shoots, which although they grow luxuriantly, are very liable to become hollow and are consequently unsuited for the production of timber of full size and value

In many cases where for instance cultivation is too difficult or where it is profitable to dispose of large quantities of firewood, advantage is taken of the great power of coppicing which teak possesses, and the trees are felled as close to the ground as possible in order to favour the development of stool shoots

The present method of exploiting the forests is the chief obstacle to their natural regeneration A block of forest is leased to a contractor and every year a certain area has to be felled, but in order that the timber (a portion of which the State is compelled to buy for its public works) may be brought to market fully seasoned and in the best possible condition, the green trees are killed by girdling about two years in advance of the felling, the girdling being preferably carried out at the commencement of the rainy season (November and December) The girdled trees lose their leaves in a very short time and owing to the increase of light and the heavy rain coming together the seed lying on the ground germinates freely, but at the same time undergrowth and weeds of all sorts spring up with the greatest luxuriance, especially the alang alang grass, and a species of lantana The ringed trees also, although they die above the girdle, send out in the course of a few months from below the girdle a mass of large leaved shoots and in a short time what was fairly clear ground becomes an almost impenetrable jungle, which is fatal to the light-demanding teak seedlings, any attempt to free the latter would be useless on account of the felling which has to be made later The few seedlings that survive are destroyed during the felling operations and when the area to be planted up is, at the close of the felling year handed back cleared of all growth, according to contract, the ensuing rains produce nothing but a very sparse crop of seedlings, as during the two previous years no new seed has been produced by the dead stems So long then as the exploitation is carried out by the above means the natural regeneration of teak is out of the question

The following is a description of the method of cultivation at present practised

As the work to be done consists mainly in planting up cleared blocks, there is no choice as to the area to be operated on. Any ground which was once covered with good teak forest possesses the necessary conditions for a new plantation, though, of course, any included patches which were entirely or principally occupied by jungle woods or were blank, require some consideration. Next to the suitability of the soil for cultivation, the most important condition is the degree of moisture contained in it. Planting is useless in places, where the latter exceeds a certain amount, or in ill drained places where water stagnates, the teak plant requiring good drainage and being very susceptible to excessive moisture. Even when mound planting is resorted to, the young plants, though they make good growth at first, very often eventually succumb or develop into badly shaped trees This also happens in the case of plantations made on ground with an impermeable subsoil, though the surface soil may be to all appearance good. The presence of more or less pure groups of junglewood in teak forest, as for instance on the banks of rivers or on low lying ground, generally points to excessive humidity and such places should be avoided

The best teak forest is found on soil derived from the tertiary formation a belt of which crosses Java in the direction of its greatest length, forming long ranges of very broken hills Here on the hard clay or marl soil which often contains a large proportion of lime and which seems to suit no other kind of tree, the teak is quite at home and grows in forests either quite pure or with a sparse admixture of other species * The forests are however much cut up by the spread of cultivation and have almost disappeared from the valleys Teak is also found on volcanic soil at the foot of the hills and on alluvial ground, but in such places it is less abundant and mixed to a greater extent with other trees The timber grown on such land is also smaller and inferior in quality to that found on tertiary soils and the more fertile volcanic soils favour a rank development of tropical vegetation which gradually drives out the teak tree

After many years of experimental teak cultivation, more or less successful, but always uncertain the system now almost exclusively adopted is that of planting or sowing combined with field crops† In Germany the crops grown under this system usually belong to the owner of the forest, by whom they are raised, but in Java they are the property of the cultivator, who in addition, is paid for the teak plants at rates which vary according to local circumstances The customary unit of area in Java is the "bahoe" or "bouw" (pronounced bau) = 7096 5 square metres or about 1 75 acres, and the rate paid varies from f 10 to f 40 per bahoe (about Rs 8 to Rs. 31 per acre), but the average usually lies between f 20 and f 40 per bahoe, (or Rs 16 to Rs 24 per acre)

The profits which accrue to the native cultivator from teak cultivation are by no means small, as he not only gets a much higher return for the two or three crops of miscellaneous produce grown on the rich virgin soil of the plantation than he would from his own exhausted fields, but receives in addition a money payment for the teak plants, besides being let off his land tax.

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* The associated trees are generally Lagerstroemia reginæ, Shoutenia ovata, Butea frondosa, and Schleichera trijuga

† Practically the same as our Burma method of Teak Taungya cultivation.
Hon Ed.

But it is nevertheless often extremely difficult to convince the suspicious Javanese cultivator of the reality of these advantages or to persuade him to undertake this form of cultivation. and it is often still more difficult to get him to carry out the conditions agreed on in a loyal manner. The Forest Department cannot use force as the contract is an optional one, and under the local laws breach of contract is only punishable when fraudulent intention can be proved. Practical considerations prevent recourse to a Civil Court, especially when the defendant is a pauper.

Consequently the negotiation and carrying out of a planting contract is a very difficult business, requiring a great deal of patience and tact on the part of the European Forest Officer; good subordinates are a great help, but they are often wanting. In some districts, for instance, Tegal and Pokolongan, in which the Taungya plantation system was introduced by the present Inspector of Forests over 20 years ago, the people have learnt to fully appreciate the advantages of the system and undertake the work willingly, but in other parts of the island it is only with the greatest difficulty that they can be induced to carry out the work, and often refuse altogether to have anything to do with it In such cases, cultivation has either to be abandoned or carried out departmentally, which costs a great deal more than contract work and is seldom as successful, owing to want of supervision, the forest charges being very large and the subordinate staff weak and often very badly paid The cost of departmental cultivation amounts to f 40 to f 60 per bahoe (Rs. 24 to Rs. 48 per acre) and under unfavourable circumstances, often to a good deal more.

A few months before the rains, which begin in November, the Forest Officer in the presence of the local Javanese headman makes an agreement with the villagers for the new cultivation, the conditions being clearly laid down and the name of each cultivator and the land he is to plant entered in a list: a part payment is generally made in advance at the same time. The negotiations do not always proceed smoothly and many meetings are often necessary before the matter can be arranged to the satisfaction of both parties. It should here be noted that the agreement holds good until the young plants are able to take care of themselves, (under ordinary circumstances a period of from 15 to 18 months) and that payment is made in instalments. The presence of the forest officer is necessary at each payment in order to prevent disputes and the pay sheets are also signed by the local native official.

The following are the conditions of contract in the district managed by the writer.

The contractor binds himself to commence preliminary work as soon as the cleared area is made over to him, towards the close of the dry season, so that the sowing can take place at the commencement of the rains,

The preliminary work comprises the more complete cleaning of the ground, pegging out the sites for the plants (the usual planting distance is 3 ft. × 10 ft.) and finally the breaking up of the ground in patches of a foot square at each peg, and as deep as the hardness of the soil will allow.

When this is done the cultivator has to sow the seed, which is provided for him by government, putting in 4 or 5 seeds at each peg.

After that he has to sow his field crops between the rows, and in carrying out the cultivation necessary for the latter, to take care of the young teak seedlings.

He must raise two field crops during the first agricultural year (1st July to 30th June) and if necessary a third crop in the following year.

In any case, he must keep the ground weeded during the second rains in order that the plantation may be handed over clear of any growth that would be likely to suppress the young trees.

The cultivator is responsible for filling up any blanks that may occur.

In return for the above work the cultivator has the right to the full use of his crop without paying the customary land tax. Any wood left on the ground becomes his property and he is paid at the rate of f 30 per bahoe (Rs 24 an acre) The payments are made in 5 or 6 instalments, the first as an advance, at the time the contract is made, and the last when the plantation is handed over at the end of the second rains

The agreement is a verbal one and is made in the presence of the headman of the district, the fact of taking the advance being considered as proof of acceptance of the conditions

The forest officer would then have no further trouble with his plantations, if only the good Javanese cultivator would adhere strictly to the terms of the contract, but as a matter of fact the plantations are generally a constant source of anxiety to the forester, the cultivator being apt either to let the time for sowing slip by or else to allow the young plants to be choked by weeds, in which case there is nothing left but to complete the plantation departmentally as far as practicable.

There are districts where owing to a wholesome competition for the contracts the people take pains to carry out the conditions of the contract and bring the plantations to a great degree of perfection, but on the other hand there are tracts where nothing will induce the people to take to the work, and where it has then to be done on daily labour, which notwithstanding the low rate of wage, 25 cents (5d.) is always much dearer than the other method.

Next to an excess of moisture in the soil, weeds are the principal enemy of the teak plant and among these the alang alang grass (*Imperata arundinacea*) is the worst. No one unacquainted with the tropics can form any idea of the dense rank growth of this grass.

In teak plantations, all that is necessary is to keep the ground clear and the soil loose during the first two years or at any rate to keep down the growth of alang alang grass As soon as the young teak trees attain a height of from 12 to 15 feet, which is usually during the second rains, they are practically out of danger and still more so in the 3rd year when they begin to close up. They are then able to withstand the numerous fires which occur during the dry season.

As the canopy becomes more complete the alang alang disappears, at least that portion of it that is above ground, and gives place to a harmless undergrowth

The teak seed ripens during the dry season (July or August) when it is shed in abundance, and is collected from the best grown trees Before sowing, the teak seed is sometimes roasted, by covering it up with straw and setting the latter alight This procedure is not necessary but is often recommended and is an old standing custom.

The seed is sown in the beginning of the rains not earlier than October and not later than December Three to five seeds are put down at each peg and covered lightly with earth At the same time, what remains over of the seed is spread out in beds here and there between the rows, or merely scattered on the ground in order to have a reserve of planting material. Owing to the protective covering of the teak seed a little dry weather does no harm and it is a disputed point whether it is better to sow just before the rains or to wait until they have fairly set in The Javanese cultivator prefers the latter, and there is often much trouble in getting him to sow early enough in the season

When the seed has been sown and the rains have fairly set in the cultivation of field crops should be started as soon as possible. Maize is one of the most suitable crops for both interests, though in many places people prefer planting a species of hill paddy, but where this plant is cultivated the soil is not so well tilled and the young teak plants are liable to suppression as the paddy ripens

If the rains are favourable, the seed germinates in about 8 days, or at most a fortnight or 3 weeks after sowing. In good years there is usually a superabundance of plants, as most of the seed germinates For transplanting quite young seedlings with from 2 to 4 leaves and unlignified stems are the best, seedlings that have come up in the previous rains should be absolutely rejected

The second crop is sown in March or April, either maize a second time, or else some such crop as cotton, castor oil, chillies, beans, tobacco, &c The forester prefers the latter, as it does not suppress the teak plants and entails constant attention to the soil

At the time of the second harvest (June or July) the weather is very dry and a thorough cleaning of the ground is necessary, as a precaution against fire. The teak plants are by this time about

5 feet high. Except in exceptionally dry years or on dry exposures, the young plants retain their uppermost leaves throughout the dry season, although older trees are leafless at this time of year.

A further tilling of the ground is desirable in the 2nd year and is indispensable where the alang alang makes its appearance or where the ground gets covered with short thick growth of grass. Dry rice cultivation is at this time very appropriate At the end of the second year the teak plant has attained a height of 19 to 20 feet but is still unbranched.

The plantations are taken over at the end of the second rains after undergoing a final weeding. Weeding in the 3rd year is only necessary in backward areas; anything that requires weeding after this is not worth the labour entailed.

The branches begin to develop in the 3rd year and the canopy gradually closes so that the weeds become fewer. If the trees are planted 3 feet by 10 feet and the growth is normal, thinning becomes advisable about the 3rd year, but for want of the necessary establishment, this measure cannot usually be carried out Later on the people of the surrounding villages undertake this work without authorization and are careful to remove the best trees.

II-CORRESPONDENCE

The Formation of Chlorophyll.

We are accustomed to hear that Chlorophyll, the green colouring matter of plants, can only be produced under the action of light The true nature of Chlorophyll does not seem to be exactly known. That it is intimately connected with starch granules has been proved, Mohl stated that the Chlorphyll granules invariably surrounded the starch granules, but Lindley found them sometimes to exist inside But it appears generaly to be understood that it is a special and vegetable green colouring matter

That light is not a *sine qua non* has been shown by Lindley who says,—

(1.) That Humboldt found Poa annua and compressa, Plantago lanceolata Trifolium arvense, wall-flower and Rhizomorpha verticillata, green in the subterranean galleries of the mines of Freyburg, although born in total darkness.

(2.) Ferns and mosses are green where other plants are blanched, and

(3) Humboldt found near the Canaries a Fucus which was bright grass green, although growing at a depth of 190 feet below water level, where the strength of the sun-light was reduced to $\frac{1}{208}$ part of a candle light at one foot's distance.

What seems to me to point in the same direction is that we frequently find the embryo of seeds a bright green, although growing within enclosures which could not perceptibly transmit light. The first seed that struck me in this manner was that of Cassia auriculata the embryo of which was enclosed in a brown testa, and that testa again in a brown pod. I then found another green embryo in a black testa enclosed in a transparent pulp and a white opaque fruit skin, then the orange seed embryo is green although embedded in a large pulp covered by a thick fruit rind. Finally the Cassia fistula fruit has a hard black woody pericarp, contains a black pulp in which are embedded seeds with a brown testa, so hard that they cannot be bitten through and inside this again is a green embryo. Doubtless there are many other instances as good as these, but if light is necessary to the green colouring matter, how can the light penetrate these black integuments? Could it be—I merely make the suggestion I have not the means of verifying it—that the green colouring matter is not a vegetable dye at all but merely ferrous hydrate? Iron is taken up by the roots of plants, chiefly I believe in the form of phosphate. A good deal of bicarbonate of lime is taken up at the same time. The carbonic acid is required for the formation of these very starch granules which surround or are surrounded by the chlorophyll granules and closely connected with the starch and chlorophyll granules are *Raphides* of phosphate of lime and other mineral salts. Could it not be then that with that wonderful power of disintegration that plant possess, ferrous hydrate is left free? Now ferrous hydrate is at first white then on contact with the air green, then on further oxidization turns greenish brown and brown. Does this not tally fairly well with the colouring of seeds and leaves? Those embryos that are white when they germinate absorb before they come above ground oxygen (not carbonic acid as they do afterwards) and immediately the cotyledons open out, they are green. Whilst the ordinary functions of the leaves continue, oxygen is given off as freely as it is absorbed in the form of carbonic acid, and there is no reason why the colour should not remain stable. When the leaves die they turn yellow and brown. I have tried to extract some of the green colouring matter by expressing it from the leaves, but have never been able to get anything more than a dirty brownish green in this fashion.

Lindley suggests a second question in regard to the colour of plants, why should the petals of flowers be so highly colored whilst the leaves are only green?

To me, it seems that the leaves only receive the crude sap, and as before stated the coloring is mineral coloring, whilst the petals receive the elaborated sap when the vegetable dyes are truly formed. This might also account for the high colouring of leaves when their functious are almost completed. Schubler and Funk have posed a theory now generally accepted, that there are two series of coloured plants (1) those which pass through all shades of yellow between green and red—the xanthic series; and (2) those which pass through all shades of blue between green and red—the cyanic series—but that it is extremely exceptional for a species—sometimes a genus—to pass from one series to the other

There are two theories started to account for this:—

(1) Schübler, Funk, Prinsep and De Candolle favor that of the yellow series containing acids and the blue series alkalis.

(2) Macquart states that there are two distinct coloring matters in chlorophyll, anthocyane which yields a blue colour by the abstraction of water, and anthoxanthine which yields a yellow colour by the addition of water. Neither of these theories appear to Lindley to be satisfactory.

What appears to me to be somewhat similar and might perhaps have some bearing on the subject is the nature and mode of preparation of the aniline dyes; yellow aniline and white aniline are formed from the combination of ammonia with phenyl; but rose aniline, blue aniline, violet aniline and green aniline require tolyl (the next higher organic radical of the phenyl series) to produce them. Might it not be that the xanthic series belongs to the phenyl group, and the cyanic series to the tolyl group? or if not to those particular groups to some such similar arrangement?

Another curious thing about the anilines that has struck me is the way in which the colours are formed from one another *chemicall*, just in the same order that pigments would be *mixed*. The following table may show perhaps more clearly what I mean than I could express it in writing.

TABLE.

		Phenyl Parts	Tolyl Parts
$\left.\begin{matrix}C_6H_5\\C_6H_5\\H\end{matrix}\right\}N$ = Yellow Aniline		2	0
$\left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N$ = White Aniline		1	0
$\left.\begin{matrix}C_7H_7\\H\\H\end{matrix}\right\}N$ = Toliudine		1	0
Toliudine $2\left(\begin{matrix}C_7H_7\\H\\H\end{matrix}\right)N+$ White Aniline $\left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N$ + Oxygen O_3	= Rose Aniline $C_{20}H_{19}N_3$ $+ 3H_2O$	1	2
Rose Aniline $C_{20}H_{19}N_3+$ White Aniline $3\left\{\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N$	= Blue Aniline $C_{38}H_{31}N_3$ $+ 3NH_3$	4	2
Rose Aniline $2(C_{20}H_{19}N_3)+$ Blue Aniline $C_{38}H_{31}N_3$ $+ 12H_2$	= Violet Aniline $3(C_{26}H_{31}N_3)$	2	2
Yellow Aniline $2\left\{\begin{matrix}C_6H_5\\C_6H_4\\H\end{matrix}\right\}+$ Blue Aniline $2(C_{38}H_{31}N_3)+$ $5H_2 + 4H_2O$	= Green Aniline		1

Thus blue and yellow make green and blue and rose make Violet and taking them in their order of proportions of Phenyl and Tolyl they range as follows —

1 Yellow
2 White
3 Green
4 Blue
5 Viole
6 Rose

A. W LUSHINGTON

11th May, 1897

The Dimensions of Trees

I enclose measurements taken of the coppice shoots growing in the plantations of Teak, in this Division.

The age of the plantation is 5 years and the stems cut back were those that had been broken down by elephants, or blown over by wind and so bent down that they were unable to recover themselves naturally

The cutting back took place from the 14th to the 17th February and the measuring was carried out on the 11th May

During the work of cutting back about 10 of rain fell, a most unusual circumstance I believe, at that time of the year.

Height	No of Shoots	Age
7 6	15	Under 3 months
7' 0"	21	,,
6' 6'	23	,,
6' 0	11	,,
5' 6"	12	,,
4' 6	7	,,
3 6"	11	,,

I should like to know how these measurements compare with measurements in other plantations

J. C LEGGE

TRAVANCORE
2nd May 1897.

I dare say the following measurements of a few trees taken by me may be of interest to some of your readers and lead to the publication of records of a similar nature by others If you think so, I shall be glad if you will insert them in your Magazine.

The Nilau Bhoto Chenar is a marvel and I fancy can't be beaten even in Kashmir I am sorry I had not my camera with me to take a picture of it.

A. E WILD,
Conservator of Forests, Bengal.

DARJEELING,
29th May, 1897.

Measurements of Trees,

Date of measurement.	Locality in which found.			Names of Trees.			Girth.		Remarks.
	Village.	District.	Province	Botanical.	English.	Vernacular.	Feet.	Inches.	
...	Sataura ...	Hazara	Punjab	Melia Azedarach, L.	...	Bakain ...	8	8	...
28th March 1890	Uterau ...	Ditto	Ditto	Olea Europæa, L.	Olive ..	Kao ...	13	...	56 feet diameter of crown.
Ditto ...	Nilau Bhoto	Ditto	Ditto	Platanus orientalis.	Plane ...	Chenar ...	36	...	At 3 feet from the ground. Forks into numerous stems at 3 to 12 feet from the base with girth measurements as follows :— No. Girth. Outer stems. 1 1' 2 5' 4" 3 2' 9" 4 1' 5 3' 9" 6 3' 4" 7 1' 8" 8 1' 11" 9 1' 2" 10 1' 1" 11 3' 7" 12 10' Inner stems. 13 10' 8" 14 10' 10" 15 10' 3" Inside stems. 16 1' 17 2' 4" 18 1' 5"
17th March 1897	Ikara ...	Gya ..	Bengal .	Tamarindus indica L.	Tamarind	Imli ...	25	6	
2nd „ „	Pokir ...	Palamau	Ditto	Bombax ...	Cotton Tree	Semul ...	*102	...	
Ditto ...	Kechki ...	Ditto	Ditto	Butea frondosa.	..	Paras Palas Dhak Chichra	12	9	

* Buttresses protruding 17 feet from main stems.

Indian Timbers for Fishing Rods.

With reference to Surgeon-General Bidie's paper on the above subject in the Fishing Gazette, I may perhaps be allowed a few remarks, as I have for some years been experimenting in this direction. Why Surgeon-General Bidie calls Thespesia populnea the Indian Seaside Mahoe, perhaps goodness only may know, at any rate I never heard it called by that name before. The wood, however, not the name, is the important thing. It is an excellent tough and elastic timber: most of the Bombay carriage wheel spokes and ekkas are made of it. I made golf sticks of it, and found it at least as good as the imported ones. It would certainly do for fishing rods, bar the top joints.

Parrotia Jacquemontiana I looked at pretty frequently, but came to the conclusion that it was not even worth trying. The wood is no doubt extremely flexible and fairly tough, but is deficient in strength and elasticity, and does not grow in a form at all suitable for rod-making. I searched for many days without finding any trees that I thought worth cutting a rod out of, and Parrotia was common enough in those forests. The Grewias I have cut into rod lengths and seasoned, and think they ought to come to the front. Those I tried were extremely tough and stiff, and elastic, but they had the defect of developing minute cracks in drying, throughout the thickness of the log, a defect that would probably be fatal for trade purposes, unless it can be overcome. The same may be said of another splendid timber, Anogeissus latifolia. Both these trees I have split up into matchwood trying to find a length free from minute cracks. Probably the seasoning could be carried out better than this. Ougeinia dalbergioides I have cut up a lot of, having had a great admiration for its strength toughness and elasticity. It is excellent for shafts and such like large work, but disappointing for fishing rods. However straight the tree, the grain will be found generally very cross and twisted, full of knots and flaws. A rod made of it would be pretty sure to warp in six months. Dalbergia Sissoo I do not think much of, Dalbergia latifolia is better and might do for top-joints. Acacia Catechu is an excellent timber but I never thought of trying it for rods, if not too brittle, it might do. Heritiera and Hardwickia should make good top-joints, though I never had the opportunity of trying them.

Lagerstroemia tomentosa I do not know, but hear that it is quite useless, Lagerstroemia parviflora and microcarpa I have tried, and found them nice, light, straight-grained, elastic, timbers, but without much strength. Gmelina arborea I never thought worth trying, and do not now, as it is a softish wood of no particular character.

The palms would be excellent, I have had real hard service out of them, they are hard, stiff, tough, elastic as need be desired, but they have the evil habit of throwing out splinters. Cut and polish with the utmost care, you have only to bend it well a few times, run your hand up it, and pick out the splinters at leisure. The wood tissue is too uneven, very hard fibres embedded in a more or less soft cellular matrix. The outside of the palm alone is good, the interior being principally pith.

F. G.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Agricultural Department, Assam Bulletin No. 3.

NOTE ON THE CULTIVATION OF RHEA IN ASSAM

Rhea is cultivated by the *raiyats* chiefly in small patches near their homesteads, in all the districts of the Assam Valley, except Goalpara. The cultivated rhea known in Assam at the present day is *Boehmeria nivea*. In the article on Rhea and China grass in the Dictionary of the Economic Products of India certain evidence is referred to as tending to show that the rhea originally cultivated in Northern Bengal and Assam was a different variety, *Boehmeria tenacissima*, and the suggestion is made that the latter kind may be found more suitable for cultivation in India than *Boehmeria nivea*, as being better adapted to a hot and moist climate. However this may be, the only plant now known and cultivated as rhea in Assam is *Boehmeria nivea*, and though a search has recently been made for *Boehmeria tenacissima* throughout the Assam Valley, not a single specimen of it has been found. So far, also, as the writer has been able to ascertain, there is no tradition among the *raiyats* that any other variety of rhea than *Boehmeria nivea* was ever cultivated in the valley.

Rhea (*Riha*) is the vernacular name by which *Boehmeria nivea* is known in the four upper districts of the valley,—Lakhimpur, Sibsagar, Darrang, and Nowgong. In some parts of the Kamrup district it is known as rhea and, in others, by the Bengali name, *Kankhura*. The wild rhea (Bun rhea), which is found in the jungle throughout the Assam Valley is also a variety of *Boehmeria* but no fibre is ever obtained from it by the Assamese, and it does not appear probable that it could ever be of any commercial value. In the Surma Valley (Sylhet and Cachar districts), no form of rhea is known to the native cultivators, but, on a few tea estates, *Boehmeria nivea* has been raised experimentally on a small scale. On the occasion of a recent visit to the Jaboka Naga tribe, inhabiting a tract of the hills to the south-east of the Sibsagar district, the Reporter on Economic Products to the Government of India ascertained that *Boehmeria nivea* is cultivated by the tribe, and that they also spin and manufacture into a coarse cloth, the fibre of a jungle plant called by them Ban rhea, which has has been identified by the Reporter as *Villebrunea appendiculata*

The soil on which rhea (*Boehmeria nivea*) is cultivated should be be light and free, not stiff, and either naturally rich, or well manured It must also be above the reach of inundation, and well drained, as the plant is at once killed by water lodging at its roots Subject to these conditions, it would appear that rhea can be grown in Assam on a variety of different soils In the Assam Valley, the rich loam which composes good tea land has been found suitable for it, and in Sylhet it is reported to be grown most successfully on well-drained *bhil* land By the Assamese, however, it is most usually raised on sandy loam, which has been artificially fertilised, chiefly with cowdung manure The crop is generally grown from root cuttings, though in some places stem cuttings are occasionally used, and, according to the statements of native cultivators can be planted at any time during the rainy season (April to October), but the months usually selected for planting are *Baisakh* (15th April to 15th May) and *Kartik* (15th October to 15th November) The more careful cultivators, if the ground is not already well-drained, and quite secure from inundation, commence operations by digging a trench about two feet deep round the patch selected The ground must be well hoed, Mr. J Buckingham, C I E, of the Amguri tea state, Sibsagar, who has cultivated rhea experimentally, considers that hoeing to a depth of at least 18 inches is necessary—and manure is applied both before and after planting The only manure systematically used by the Assamese, and considered by them indispensable for rhea, is cowdung, Mr Buckingham however, thinks that decomposed vegetable matter is the best manure As rhea is grown by the native cultivators close to their houses and cattle sheds, an abundant supply of cowdung manure is usually available for the crop, wood ashes from the cooking hearth are sometimes thrown on the ground, where rhea is grown, but they are not regularly used as manure Some cultivators mention the use of rice husks as manure for rhea, while others state that the husks are spread on the ground for the purpose of attracting field mice, which render assistance by nibbling, and so reducing the size of the rhea roots, when the excessive growth of the latter results in overcrowding and the consequent deterioration of the stems This statement the writer has not had an opportunity of verifying The root cuttings are planted in rows from two to three feet apart, with about the same distance between the rows, and about six inches deep Mr Buckingham recommends planting in trenches about three inches deep and earthing up the shoots as they appear above ground In applying manure after planting, it is important to avoid choking the shoots by its excessive use Where the crop is grown near a village, it must be protected by a strong bamboo fence, as cattle and goats are very fond of the leaves and tops of rhea

In the experiments made in rhea cultivation at Saharunpur, it has been found that the stems produced are usually unfit for conversion into fibre, owing to the irregularity of their growth, caused by alternations of dry and wet heat the result of which is that the fibre which they contain is not of uniform quality throughout and that the difficulty of extracting it is enhanced In the Assam Valley the cultivation of rhea does not appear to be attended with this difficulty At Saharunpur and in all other parts of Northern India, except Assam, little rain occurs during the months of the cold weather (November to March) and the early part of the hot season, comprised in the months of April and May, and the first half of June, is characterised by intense, dry heat In Assam there are no dry, hot months, the rains setting in regularly by the middle of April, and even during the cold weather humidity is greater than in other parts of Northern India Accordingly, in Assam, rhea continues growing throughout the year, though at a somewhat slower rate in the cold weather than in the rains, and whereas, at Saharunpur, the crop is cut only twice a year, once in June and once in October or November, in Assam cuttings are obtained at much more frequent intervals as will be shown further on According to the statements of numerous cultivators who have been examined, there is no difference as regards the quality of their fibre, or the difficulty of separating it between rhea stems cut in the cold weather and those obtained in the rains The writer has seen, in March, at the end of an unusually dry cold weather, in [illegible] Assam, stems over six feet high, and apparently uniform, of rhea plants which he was assured, had been cut only two months before The rapidity of growth, however, especially during the cold weather, depends much on the amount of manure applied and the general care taken in the cultivation. The stems just referred to were grown on carefully tended land, while, at the same time and on land of probably the same natural fertility, the rhea crop observed was withered and stunted, and not likely to yield any fibre till the beginning of the rains.

Proverbially careless and unthrifty, the Assamese *raiyat* is little disposed to take trouble with a crop like rhea, the produce of which is required by him only in small quantites for domestic consumption. It is hence, somewhat difficult to estimate from Assam experience what the crop is capable of under careful cultivation In the majority of instances, except a little weeding during the first few months of growth, nothing is done for the rhea patch after planting and its owner looks only to cutting the stems as often as they become fit for use Under this treatment, after two years the soil becomes exhausted, and the rhea stems grow weak and thin, the roots are then taken up, divided, and replanted elsewhere The more intelligent *raiyats*, however, admit that, with frequent manuring, rhea can be continuously grown on the same land for many years, indeed they place no limit on the length of time for which the crop can be cultivated on the same land if only manure enough be applied. There is room for doubt as to what the maximum period is. In reports from China and America very long periods, varying from 30 to 100 years have been mentioned, but it seems probable that unless some process of thinning were resorted to, transplanting at comparatively short intervals would be necessitated by the overcrowding of the roots. In paragraph 8 of Mr. Montgomery's report on the experimental cultivation of rhea in Kangra (Dictionary of Economic Products, Volume VI, Part I, page 472) the removal of the roots every four years is recommended, in order to avoid overcrowding. On the other hand, in the report of the Superintendent of the Botanical Gardens, Saharanpur, quoted at pages 476 481 of the same volume, close planting is advocated, with a view to preventing the growth of weeds and improving the quality of the fibre. By the Assamese the crowding of the roots as well as the impoverishment of the soil, is sometimes alleged as a reason for re-planting the crop on fresh land, but the writer has seen rhea flourishing on land where it is said to have been grown continuously for eight years without thinning.

In different published descriptions of rhea cultivation, in which the number of cuttings that can be obtained in a year is referred to, it appears to be implied that, at certain intervals, the whole of the stems from roots planted at the same time in a field can be cut simultaneously. This however is not the usual practice in Assam, where the received opinion is that, in order to obtain the greatest outturn and best quality of fibre, each stem must be cut at a certain stage of its growth, namely, when the lower portion of the stem turns brown, and before the plant has flowered. As all the stems from roots planted together do not reach this stage simultaneously, the custom is to cut selected stems from time to time as they become fit for use. In this way selected stems are cut at intervals of from one to two months in the rainy season, and from two to three months in the cold weather. Rhea planted at the end of the rainy season (October to November) will yield the first cutting about the end of March or beginning of April, if planting be carried out at the beginning of April, the first cutting may be obtained about the middle of May. When the crop has fairly established itself, cuttings may be taken regularly at the intervals mentioned above.

No irrigation is required for rhea in Assam. Between the time of planting and the first cutting, constant and careful weeding is necessary, but, after that, light hoeing between the rows after each cutting and manuring once a year, if the soil be poor, seems to be all the cultivation that the crop requires.

The method of preparing the fibre in Assam has been described in reports previously published, and may be briefly recapitulated here. After the stems have been cut, the leaves are stripped off, and the green outer cuticle removed by scraping with a knife. The stems are then dried in the sun for from four to six days, after which the bark is peeled off, and left to steep for two or three hours in cold water, in which pieces of some acid fruit are sometimes placed along with it. The acid appears to have the effect of dissolving the gum contained in the bark, and facilitating its removal. After this steeping, the fibre is separated by washing the bark in clean water and rubbing it between the hands.

It is necessarily very difficult to estimate, from the statements of native cultivators, the average outturn of cleaned fibre which may be obtained from a given area of land under rhea which is properly cultivated. As mentioned above, careful cultivation of this crop is the exception, and the *raiyat* who raises it, as a rule on a diminutive patch not exceeding three or four perches in extent, keeps no strict account of the fibre which it affords, a few handfuls at a time, for domestic uses. The Assamese peasant is, moreover, strongly averse to giving any information about the outturn of his crops and any statements he makes on the subject are usually under-estimates. Calculations based on such statements, which may be taken for what they are worth give estimates of outturn for rhea varying from 76 lbs to 605 lbs of cleaned fibre per acre. On the other hand the estimate deduced from an experiment made in the Nowgong district jail in 1885 was 911 lbs per acre. Mr Buckingham estimates the outturn under favourable circumstances at 640 lbs per acre, and this may probably be taken as a safe estimate for Assam. Mr Montgomery, after twelve years' experience of rhea cultivation in Kangra, estimated the outturn of cleaned and dried fibre at 972 lbs per acre, but it seems doubtful whether the fibre produced by him was as thoroughly cleaned as that prepared by the Assamese method.

There are no accurate statistics of the area under rhea in Assam. The crop is found, here and there, throughout the five districts of Kamrup, Nowgong, Darrang, Sibsagar, and Lakhimpur, and is raised by cultivators of all classes, not by the fishing caste only, as has been stated. In spite of this wide distribution, the total area under rhea is unimportant. In the districts named, its cultivation is confined to a small proportion of the total number of villages, and in any one village as a rule, not more than half a dozen *raiyats* will be found who cultivate it, while the average area cultivated by each *raiyat* is, as already stated, extremely small.

In the whole of the Assam Valley, the total area under rhea probably does not exceed 2,000 acres. The small extent of rhea cultivation in Assam is easily understood, when the labour involved in preparing the fibre is taken into account, and when it is considered that the Assamese manufacture from it fishing nets and lines only, and are unacquainted with the higher uses to which it can be put.

Whether rhea can be successfully grown on a commercial scale in Assam, is a question which can only be determined by experiments, such as are more likely to be carried out in a satisfactory manner by private agency, than by a Government department. It is certain that, on this point, no conclusion can be safely drawn from the existing cultivation in the province, which is everywhere of the nature of garden cultivation The data bearing on this question, which are available, will, however, be of interest to any one proposing to make an experiment with the rhea crop, and it appears desirable that they should be laid before the public. There seems to be no doubt that the climate of the Assam Valley districts is favourable for the cultivation of rhea (*Boehmeria nivea*) throughout the year while waste land suitable for the crop is available in abundance in those districts On the other hand, there is no probability that the cultivation of rhea will ever be undertaken on a large scale by the Assamese *raiyat*, owing to the labour involved in the separation of the fibre by hand, and to the fact that any machinery or process by which it could be more easily extracted would be beyond the *raiyat's* means The present condition of the Assamese peasant is such that he is not compelled to engage in any laborious occupation in order to obtain a subsistence which is all that he requires, and even the trouble of preparing jute for the market has been sufficient hitherto to deter him from the cultivation of that crop, in spite of the large profits which it would probably yield him So far as present indications go, it appears that if rhea cultivation is ever to become an important industry in Assam, it must be established there, like the tea industry, by European capital, with the help of imported labour Before investing capital in this speculation, it would be well if parallel experiments could be made with *Boehmeria nivea* and *Boehmeria tenacissima*, in order to decide which variety thrives best in the Assam climate.

In estimating the cost of rhea cultivation, the frequent manuring which would be necessary, if any but the very richest soil were selected, must be taken into account as an item of expense; but, with regard to this, it may be pointed out that cattle dung has at present no selling value in Assam, not being generally used either for fuel or manure. Immense quantities of this manure at present go to waste annually in Assam, so that its cost would probably be little more than the expense of collecting it and conveying it to the plantation. With reference to the statement of the cost of the experimental cultivation in Kangra, given at page 474, Part I, Volume VI of the Dictionary of the Economic Products of India, it may be observed that rent at Rs. 10. per acre has there been shown as an item of expense; whereas, in Assam, under the rules for the settlement of waste land for special cultivation, land could be obtained for rhea on thirty years' lease, after certain preliminary expenses, for two years' revenue free, and afterwards at progressive rates rising to Re. 1 per acre, the lease being renewable on its expiration at the ordinary rates of revenue which may be then current in the province Irrigation, again, which is required for the rhea crop in Kangra, would not be needed in Assam. On the other hand, nothing has been allowed for cost of manure in the statement referred to, and the cost of labour would be considerably greater in Assam than in Kangra

A question which has to be decided is whether the production on the rhea plantation of cleaned fibre, or of the article now known in commerce as rhea ribbons, that is strips of rhea bark containing the fibres as well as the dried juice or gum, with the outer cuticle adhering, should be aimed at In the rhea industry, as it at present exists in Assam, dried ribbons are not produced, the outer cuticle being scraped off immediately after the stems are cut, but, in an article which appeared in the issue of *Capital* of the 4th August 1896, it is stated that, in an experiment made on good soil, the average outturn of dried ribbons obtained, was 1,600 lbs per acre Taking this rate of outturn, it is hardly probable that a plantation could be profitably worked in Assam to produce rhea ribbons, the price of which at Indian ports of export is quoted at only £7 per ton This low price is due to the fact that the quality of the fibre contained in the ribbons cannot be gauged at the time of purchase, and also to the heavy percentage of waste matter on which freight has to be paid when ribbons are exported In order to offer satisfactory prospects of profit, it would seem that the cleaned fibre must be produced on the plantation, and it is certain that in Assam, this could not be done by hand labour, after the native method, except at a prohibitive cost. Some machinery or process seems, therefore, to be required, which shall be simple enough to be put in operation on the plantation itself, and which shall produce, from the fresh cut stems of rhea, cleaned and degummed fibre in the condition in which it is required by the manufacturer in Europe

F. J MONAHAN,

Shillong,

The 12*th April* 1897.

Offg Director, Department of
Land Records and Agriculture, Assam.

Budget Estimates of Revenue and Expenditure for 1897-98.

	REVENUE	EXPENDITURE.
	Budget Estimate 1897 98	Budget Estimate 1897-98.
India General —	R	R
Andamans	3 43 000	2 19 000
Baluchistan	14 000	32 000
Ajmere	17 000	16 000
Coorg	1,60 000	84 000
Forest School	3 000	70 000
„ Survey		34 000
Indore	3,000	2 000
Bangalore	10 000	1 000
General Direction		78 000
TOTAL INDIA GENERAL ...	5 50 000	5,36 000
Central Provinces	9 32 000	10 20 000
Upper Burma	22 98 000	8,48 000
Lower „	34 77 000	14 66 000
Assam	4 70 000	3 60 000
Bengal	13 00 000	7 07,000
North Western Provinces and Oudh	16 65 000	10 00 000
Punjab	12 12 000	8 86,000
Madras	23 73 000	17 25 000
Bombay	32 85 000	22 32,000
TOTAL INDIA	1 75 62 000	1,07 80,000
England		19 000
Exchange		12,000
GRAND TOTAL	1 75,62 000	1,07,61,000
SURPLUS	68 01 000	

VI.-EXTRACTS NOTES & QUERIES

The Timber Supply of the British Empire.

By Professor W Schlich, C. I. E., Ph. D.

When I, at the invitation of the scientific director of the Imperial Institute, undertook the task of reading a paper on the timber supply of the British Empire, I thought that I had sufficient material for the purpose, but the deeper I went into the subject the more I found that the information which is necessary to deal satisfactorily with the question is very incomplete There is indeed a vast amount of information available, but it is in many cases given in such general terms that it is not easy to draw correct and reliable conclusions from it It is, for practical purposes, of very little use to find it stated that a large area of forest is available in a certain country, since that may mean much or very little indeed In only too many cases the areas include large tracts of country which contain little or no useful timber, while in others the composition of the forests and the proportion in which the valuable timber trees participate in it are not given, and can only be roughly guessed Under these circumstances I have tried to make the best of the available information, and I trust that the remarks which I am about to address to you may not be found unacceptable At the same time I hope that I shall have your kind indulgence in case I should have fallen, here and there, into error

The question of the timber supply of this mighty Empire is of such extent, that it would be impossible to deal with it exhaustively in the course of an hour hence I shall have to restrict myself to the consideration of a few points which deserve our special attention.

The British Empire is of enormous extent, covering an area of about 9,000,000 square miles, with a population of some 350,000,000 people, leaving out of consideration the lately acquired territories in Africa, about which our information is as yet incomplete This huge area is scattered over the face of the globe from the North Polar region to the 55° of southern latitude, including all shades of climate from eternal snow and ice to tropical heat, and a rainfall ranging from absolute aridity to more than 500 inches a year

A further aspect presents itself in the density of population, which differs from the maximum to be found on the earth to the total absence of inhabitants from large areas

It is obvious that the forestry question of such an Empire cannot be dealt with wholesale, but that it must be studied and

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* Read at the Imperial Institute, 20th March.

answered for each part separately. And yet as regards the timber requirements of the whole a fair idea can be formed, and conclusions arrived at, in how far the available supplies are likely to meet the demand.

This is, therefore, the subject with which I propose to deal to-night, though necessarily only in skeleton form.

The annual statements of the trade of the United Kingdom with foreign countries and British possessions laid before Parliament give the imports and exports of timber into and from the various ports of the Empire, and they thus enable us to estimate the requirements and supplies I have, therefore, prepared Table I., which shows the mean annual imports and exports for the two periods of 1884 to 1888, and 1890 to 1894.

TABLE I.

Average Annual Net Imports and Exports of Timber into and from the several parts of the British Empire, calculated from the Returns for 1884 to 1894.

COUNTRY.	PERIOD 1884–1888.		PERIOD 1890–1894.	
	Net Imports	Net Exports.	Net Imports.	Net Exports.
	£	£	£	£
Great Britain and Ireland .	15,000,000		17 595,000	...
Australasia	1,284,000	...	1,233 000	...
Cape of Good Hope ...	72,000	...	160 000	...
Barbadoes	24 000	...	65,000	...
Trinidad	49 000	...	41,000	...
British Guiana	37,000		41,000	...
India	...	511,000	..	682,000
Ceylon	...	27 000	...	22,000
Dominion of Canada ...	...	4,025 000	...	3,956 000
Jamaica	...	175,000	...	312,000
British Honduras ..	...	...	...	142,010
Total	16,466 000	4,738,000	19,135,000	5,114,000
Net Imports into the Empire	11,728,000	...	14,021,000	...
Increase of Imports in six years	...	...	2,293 000	...
Mean annual increase ...	..	...	382,167	..

This table is not quite complete, because some of the smaller colonies have been omitted, as well as the newly acquired territories in Africa. In some cases, certain quantities of timber could not be traced, as they had been included under other headings, as for instance, railway materials. On the other hand, some of the items include logwood, which is used for dyeing purposes, and not as timber. Still, on the whole, the table is very instructive, because it exhibits the following facts:—

1 The net imports of timber into the British Empire amount now to the value of £14,021,000 a year,

2 They have increased in the course of six years by £2,293,000, or at the rate of about £382 000 every year.

I should mention, in addition, that wood pulp amounting in value to 1⅓ million pounds is now annually imported into Britain which is not taken into account in the above table.

3. The United Kingdom is by far the greatest importing country, the *net* imports amounting to timber valued at £17,600 000. Next comes Australasia with £1 250,000; Cape Colony, £160,000; Barbadoes, £65,000; Trinidad, £41,000; and British Guiana, £41,000. All these colonies export certain quantities of timber, especially hard woods; but they import so much soft wood (pines and firs) that the balance of imports and exports is against them

Amongst the exporting British possessions, the Dominion of of Canada stands first with £3 956 000, then comes India with £682 000: Jamaica with £312,000 (which sum includes, however, much logwood and transhipments from other counties); British Honduras with £142,000; and Ceylon with £22 000

4. Taking the Colonies and India by themselves, the net exports amount to £3,574,000 Deducting this amount from the imports into the United Kingdom, we arrive at the net imports into the Empire, amounting to nearly £ 4,021,000.

5 While the annual net exports of the Colonies and India have increased by only about £400.000, the net imports into Britain have increased by nearly £2 600,000

Here, then, are facts which demand attention, and we may well ask—

1 Whether future supplies are sufficiently assured? and

2. Whether measures cannot be taken to provide, by degrees, the necessary timber from sources *within* the Empire, thus preventing this large sum of money going every year to foreign countries?

With a view to answering these questions, we must, in the first place, inquire where the timber comes from and of what description it is. For this purpose we cannot do better than examine the imports into the United Kingdom, since they are much greater than those of the Colonies put together. I have, therefore, compiled Table II, showing the imports into Great Britain and Ireland during the year 1894, this representing about the average of the five years 1890-4.

TABLE II

TIMBER IMPORTED INTO GREAT BRITAIN AND IRELAND DURING THE YEAR 1894 VALUE IN £ STERLING

Country whence Imported.	Fir, Hewn and Sawn	Oak, Hewn and Staves	Teak	Mahogany	Other Furniture Woods	House Frames	Miscellaneous	Total	
	£	£	£	£	£	£	£	Loads	Value £
I BRITISH EMPIRE									
Canada and Newfoundland	3 172 283	147,948			25 175	19 520	187 551	1,391 199	3 552 477
West Indian Islands, Honduras Guiana.	–			116 547	4 971		24 756	19,141	146 274
Gold Coast and Niger Protectorate				62 713	4 134			7,676	66 847
East India and Straits Settlements			404 445		28 937	3 989		43 251	437 371
Australasia	24 557				40 648	566		12 222	65 771
Other British Possessions	125	50		2 418	1 520	1 577	54	988	5,744
II FOREIGN COUNTRIES									
Russia	3 721 027	144 411			20 153	9 473	75 498	1 999 061	3 970 492
Sweden	3 840 478	22 893	–	–		89 161	34 665	2,108 276	3 977 607
Norway	1 369 455	55 332				2 768	8 058	760 471	1 435 613
Germany	548 025	283 161		11 423	14 732	115 993	19 445	353 053	992 779
Holland and Belgium		4 499				139 516	37 264	43 702	181 278
France, Spain, and Italy	549 094	3 398			27,072	69 366	44 243	754 343	693 173
Austria		58 827				4 755		6 787	63 582
United States of North America	1,153,663	477,046		15 128	365 681	206 922	138,387	668,181	2,356 827
Mexico, Honduras Columbia Venezuela, West Indian Islands.				261 308	43 107			42,477	304,415
Siam			54 102				–	5,649	54,102
Other Foreign Countries	14 620	11 685	7 162	52 392	98 132	4 219	1 047	19 950	119,157
Total British Empire	3 196 965	147 998	404 445	181 678	105 385	25 652	212,261	1 474 477	4,274 484
Foreign Countries	11 186 342	1 061 182	61 264	340 181	498 877	642 673	358 536	6 761 900	14,149 055
Grand Total, Value	14 383 307	1,200,180	465 709	521 859	604 262	668 325	570 897	8 236 377	18,423,539
Number of Loads	7 437 763	242 861	44 333	65 494	87,108	167 061	191 737	8,236,377	
Mean Value per Load in £ s d.	£1 18 8	£4 19 7	£10 10 1	£7 19 4	£6 18 9	£4 0 0	£2 19 7		£2 4 9

(1) THE first fact which Table II teaches us is, that of the timber, valued at £18 423 000, only £4 274 000 came from British possessions while foreign countries sent us £14 149 000, or just about the average annual imports into the Empire

(2) The second point which deserves our attention is the description of timber imported Passing over the miscellaneous timber we come to what is classed as house frames, valued at £668 000 This is worked-up material, coming to a considerable extent from countries which are themselves importing timber, hence it does not represent production but cheaper labour than we have in this country The next items are the fancy woods, leaving out mahogany £604,000 Half of these come from the United States of America and the other half from a number of other countries The mahogany £521,000, comes chiefly from Mexico and British Honduras

Teak valued at £465 000 comes chiefly from East India

The oak value £1 203 000 comes from the United States, from the countries around the Baltic Canada and a few other countries

The pine and fir timber value £14 383 000 comes chiefly from the Baltic Canada United States and France This is the most important item on our list forming 90 per cent of the total imports

(3) The third point is the rate at which the timber is laid down at these shore Table II shows that teak is valued at about £10 a load mahogany £8 other fancy woods £7, oak £5, and pine and fir £1 18s 8d

Not only does firwood form the bulk of the imports but it is also landed at so low a rate that none of the other woods could replace it were the supply of it to fall short As bread is the staff of life so are fir and pine the mainstay of all industries which work in timber Hard woods with the exception of oak, are more or less luxuries the consumption of which can be reduced without seriously inconveniencing the people of this country but a falling off in the supply of fir would certainly be a calamity

Having thus indicated the relative importance of the several classes of timber, I shall now proceed to enquire into the safety or otherwise of future supplies For this purpose I shall deal with the several regions whence the timber comes

		£ value.
1	Countries around the Gulf of Mexico, the Caribbean Sea, Mexico Honduras Columbia Venezuela West Indian Islands	450 689
2	Gold Coast and Niger Protectorate	66 841
3	Australia	65 771
4	East India Straits Settlements Siam	491 473
5	Austria	63 582
6	Holland and Belgium	181 276
7	France Spain and Italy –	693,172
8	Countries around the Baltic—	

	Germany	£992 779	
	Norway	1 435 613	
	Sweden	3 977 607	
	Russia	3 970 492	
			10 376,499
9	United States of America	2 356 827	
	Canada	3 552,477	
			5,909 304
10	Other countries		124 931
	Grand total		£18 423 537

The countries around the Gulf of Mexico and the Caribbean Sea have sent us £450 689 in the shape of mahogany and other fancy woods. Of these countries the two most important are Mexico and British Honduras. Of the former I cannot give you any reliable information, but about the latter I propose telling you something, because I think an effort should be made to perpetuate and increase the supplies from this source.

British Honduras has an area of 4 096 000 acres, of which about 20 000 are under cultivation, leaving over four millions under forest and jungle.

The population is, I believe, under 40 000. The average annual imports from Honduras to Britain, calculated from the years 1890 94, amounted to—

	Tons	£ Value
Timber, chiefly mahogany	16 395	142 308
Logwood	15 680	123 433
Total	32 075	265 741

If I have understood the returns correctly, these imports correspond to some 97 per cent of the total imports from Honduras to Britain, so that practically the very existence of the colony depends on them. And what has the colony done to preserve that export?

In 1885 the Colonial Office deputed Mr E Hooper, now a Conservator of Forests in Madras, to report on the forests of various West Indian possessions, and this is what that gentleman says as regards Honduras:—

'It is a prevailing belief in the colony that the supply of mahogany is not being reduced, and there is abundant proof of there being a large amount still standing, but unfortunately it is so far from the seaboard as to be utterly valueless under existing conditions of transport and with the prices at present ruling. It is equally certain that the system of cutting among private mahogany venturers is decidedly tending to extirpate mahogany wherever accessible.

'Mahogany, although naturally distributed all over the country in the south of the colony, except in pine ridges, is at the present time only found far up the rivers. . . . With the removal of timber ten inches square, and every tree of larger dimensions, there can subsequently be little or no reproduction, and unfortunately the tendency of the market is to require small wood—the mahogany being put to many more uses than formerly—so that there is little hope that cutters will respect undersized wood.

"The wood brought to the coast from the western district during recent years has been, on the whole, of larger dimensions, and it is certain that much large timber does exist in hitherto unexplored parts, measuring up to 72 inches square and even more, but to find such large trees now one has to go to the frontier, whereas, from all accounts, similar trees have been felled and extracted within the century, in accessible places whence there is at the present time only an export of small wood."

Mr. Hooper winds up by saying:—'All points, therefore, to the mahogany trade in British Honduras as having to pass through a period of serious depression, and it is questionable whether it will continue to be an important factor in the progress of the colony.'

Mr. Hooper mentions that certain rules have been made to prevent the cutting of undersized trees (15 in. and under), but he states:—'If the Forest Clauses of the ordinance are calculated, at first sight, to protect the species specially referred to, as well as the forest at large, I fail to see how they can be enforced unless precautions are taken to ensure their being respected. From all accounts I understand that great laxity has prevailed hitherto in checking the cutting of mahogany. If such a system continue, the ordinance, as far as forest protection is concerned, will be practically valueless.'

As already stated, the bulk of the exports of Honduras consists of timber. At the same time only about 20,000 acres are under cultivation, leaving upwards of 4,000,000 acres of forest waste land. If ever a case was made out for the preservation and careful management of the forests of any colony, it is for those of British Honduras. To allow matters to go on as in the past means the destruction of the exports of the colony, ending in financial and general ruin. By looking after the forests, on the other hand, exports might rise to several times the present amount, and be permanently maintained, especially as the available stocks of mahogany and logwood in non-British ports are sure to fall off as time goes on.

And here I should like to offer a few remarks on the present question in the West Indian possessions generally.

Mr. Hooper, in his reports on Honduras, Jamaica and a number of the smaller islands, shows that in many of them, mahogany is indigenous, while it has been introduced into others, where it grows well. From many an export of logwood is carried on, but of timber proper little is exported. His opinion is that, in the case of all, the forest question deserves special attention and he makes various proposals regarding the management of the forests;

more especially he suggests that thoroughly competent forest officers should be be secured, adding that the smaller islands might share one of these His proposals were reported on by the botanical advisers of the various Governments, and these invariably stated that the special forest officers were not wanted, as the heads of the Botanical Department could very well look after the forests in addition to their more legitimate duties.

Now gentlemen, this is a mistake, and I shall tell you why. Botany is pre-eminently a science, which has led to the development of industries based upon the production of the land, while forestry is an industry in itself. No doubt it is an industry based upon science, as most industries in these days are, or ought to be. This has been set forth during the last few years in endless papers, pamphlets and reports in connection with the development of the trade of the United Kingdom

In the prosecution of an industry the economic point must always be pre-eminent, and this has as far as I am aware, rarely been fully realised wherever a botanist has presided over the administration of forest estates The business is not in their line, and as a rule they have not the time to follow up the intricacies of a practical industry

At any rate the results in the British West Indian possessions have not been satisfactory Here all energies have been devoted to the production of sugar and various other agricultural products. You also know that sugar hitherto the most important of these articles is being driven out of the market, and I fear that even the Commission which is now investigating the subject on the spot will not be able to arrest the rapid decline of this industry. In the meantime the income which may be derived from the forests of these possessions has comparatively speaking, been neglected

It appears to me that a strong effort is now called for to introduce a more rational system of management into these forests, by which the export can not only be maintained, but considerably increased as time goes on For this purpose Mr Hooper's advice should be followed, that is to say competent forest officers should be engaged—say one each for British Honduras, Jamaica, and possibly British Guiana while the smaller islands should engage one between them The expenditure on such a measure is really trifling when compared with the interests at stake

With competent advice at their disposal the Governments of the various colonies would soon bring the forests under proper protection and systematic management

From Australasia we received in the year 1894 pinewood valued at £24,557 , furniture materials, £40,648 ; house frames, £566 ; total, £65,771 ; total loads 12 222. This gives an average of £5 9s 4d a load Since then a rapid increase of the imports has taken place It is said that the value of the Kauri timber imported from Tasmania during the year 1896 amounted to the value of £270,000 ; while some of the Eucalyptus have come into demand for street-paving blocks. I have seen it stated that the forests of Western Australia contain marketable timber to the value of £120,000 000. At the same time it must not be overlooked that Australasia, as a whole, is still an importing country, and that the timber imported into Britain from this source cannot be laid down at a low rate ; hence there will certainly be a limit for the development of this trade. As to the manner in which the Australian forests are managed I have, on a former occasion (before the Royal Colonial Institute), given a considerable amount of details which showed that extremely wasteful methods prevailed. Later information fully confirms the opinion which I then expressed. Only two days ago the following extract from a Sydney paper came into my hands,—

"Unfortunately in this colony, with perhaps one solitary and short lived exception the Forest Department has never had the benefit of a competent head with the natural result of its maladministration. Shifted about as it has been like a shuttlecock, out of one department into another backwards and forwards, and back again, under it ever changing regulations and ever regarded with an evil eye in Parliament it has at last, under its present management little vitality left in it with the fast approaching consequence of the country soon becoming almost entirely denuded of its best timbers, when undoubtedly there will be an outcry when it is too late.

"That the heads of this department know so little of forest matters, and have not taken more interest in them, is much to be regretted but what makes matters so much more serious is the policy of the Secretary for Lands which seems to be the cancellation of reserves and the alienation of some of our very best timbered country. This suggests the query. Does he comprehend the full import to the future of this colony of what he is doing? Be that as it may such a state of things is being brought about in regard to our timber supply and forest area as is almost unprecedented in any other country and is a reflection upon our intelligence as it will, before very long, land us in serious difficulties the fast approach of which urgently demands the independent and unbiassed investigation of a competent board of inquiry.

"At the present time the supervision of our forests (which was always inadequate) is little better than a farce and is made quite subordinate to the inspection by the foresters of conditional purchases while the forests are being devastated in the most ruthless manner. But what perhaps makes their (the forests') position, and consequently our timber supply in the future so much more critical and precarious is the fact of an uninformed public on such matters taking so little interest in them while their representatives in Parliament are too often making political capital out of them in the propitiation of their constituents—the timber getters—for whom, in exchange for their support, they are ever seeking further concessions, while on their own part they act as though they had a special right to a monopoly of the forest to cut down and destroy, to suit themselves at their own sweet wills and pleasure, without let or hindrance of any kind."

Let us hope that the forests of Western Australia will not share the same fate as that which has overtaken the forests in the other Australian colonies. After all, the estimated stock of timber represents only six years' supply to Great Britain and Ireland.

As to the Kauri forests of Tasmania, they could not supply this country for even that length of time, apart from the fact that this pine timber could not be laid down at anything like the price of the pine which we receive from the Baltic and from Canada.

The next item on our list is the supply of teak and a moderate amount of fancy woods from East India.

A properly organised Forest Department was started in India in 1864. During the thirty-three years which have since passed an area of 72,000,000 acres of forest has gradually been taken under the management of the department, 48,000,000 being constituted under the existing forest laws as permanent forest estates. There are perhaps some 60,000,000 acres of private jungles, but these, not being under control, are deteriorating rapidly, and they can can only be relied on to yield in the future small stuff, fuel, grazing and other minor produce.

The above mentioned Government forests must be relied on to furnish the necessary timber for a population of about 225,000,000 people, and for public works. But besides, they must yield large quantities of fuel, and especially of grazing, so important in times of scarcity, as at present, so that the total out-turn of timber, even under the most careful management, is not likely to rise above 2,000,000,000 cubic feet a year, which is equivalent to about 10 cubic feet a year per head of population. Hence the export from India will always be confined to teak and a number of fancy woods None of these could be laid down in Britain under £5 load, and most of them not at that. At the same time the management of the Burma teak forests has now been placed on such a basis that the quantities available for export will considerably rise as time goes on, thus relieving perhaps the pressure on other hard woods, if their supply should fall off.

And here I may add a few words about the financial aspect of the Indian Forest Conservancy. In 1864, when the Forest Department was established, the NET revenue of the department amounted to 678,000 rupees. Now it has risen to 8,000,000 rupees; and besides forest produce to the value of about 6,000,000 rupees is annually given from the State forests, *free of charge*, to the people, so that the total net profit from these estates amounts now to some 14,000,000 rupees a year. The policy which has brought about these splendid results was originated by that great statesman Lord Dalhousie, sometime Governor-General of India, and I trust that the enlightened views which he held will ever be remembered by his successors. From time to time pseudo philanthropic views have threatened the operations of the Department with reaction but fortunately the pendulum soon began to swing again in the right direction, and it is to be hoped that it will continue to do so

Next to India and Ceylon the Cape of Good Hope has done most towards the introduction of a systematic management of its forests, and yet what do we fined there? According to information supplied by the Chief Conservator, the indigenous forest that once clothed the slopes of the Table Mountain Range has disappeared, with the exception of a few trees in the deepest gorges, where fire and axe could not reach them To a great extent they have been, or are being replaced by plantations of exotic trees, such as the Cluster Pine (*Pinus Pinaster*), the Stone Pine (*P. Pinea*). the Oak (*Quercus pedunculata*), the White Poplar (*Populus alba*). the Blue Gum (*Eucalyptus globulus*), Red Gum (*Eucalyptus rostrata*), Karri (*Eucalyptus diversicolor*), Plane (*Platanus occidentalis*), pencil Cedar (*Juniperus Virginiana*, Pinus insignis, Pinus Canariensis, Jerusalem Pine (*Pinus halepensis*), Camphor Tree (*Laurus camphora*), American Black Walnut (*Juglans nigra*), American Ash (*Fraxinus Americana*), and Australian Wattles (*Acacia decurrens*, var., *mollis* and *pycnantha*, *saligna glaucophylla*, *cyclopis*).

There is historic evidence that most, if not all the ranges of mountains for hundreds of miles inland were at one time clothed with beautiful timber forests of an evergreen, laurel-like character. According to the latest information there remain now—

		Sq miles.		Acres.
In Cape Colony	...	550	...	350,000
In Natal .	...	259	...	160,000
In Zululand, about	...	75	...	60 000
Total	...		...	560,000

The whole of the 350,000 acres in Cape Colony is public property, in charge of the Forest Department. Under proper management they cannot be expected to yield more than 15 000,000 cubic feet or about 10 cubic feet per head of the present population. At present, however, they yield nothing like this amount; hence the Cape has imported of late years, on an average timber to the value of £160,000, of which two-thirds are pine and fir timber; and the plantations which are now being made consist chiefly of such species, principally cluster pine

Of the 160.000 acres of Natal timber forests more than three-fourths have been alienated, and are being rapidy destroyed.

As far as authentic information goes, the wooded areas in the Transvaal, Bechuanaland, and Mashonaland are, as timber forests, of secondary importance, the trees being usually of stunted growth and excessively hard

To sum up, it may be said that the Cape Colony and Natal have not enough timber for their own consumption, and they are not likely to be in a better positon for many years to come, for the growth of forest trees is slow

It is interesting to notice that the Chartered Company of South Africa has already established a Forest Department, but as far as our scanty information goes at present, it will be as much as that Department can do to provide the Colony with timber, and in all probability it cannot do that much

In Rhodesia the forests are described as little better than scrub in the plateau country, in the low lands the forest is said to be better, but very unhealthy Proceeding now to European countries we find that Austria sent us 6 787 loads valued at £63 582, making an average of £9 7s 4d a load The timber consists chiefly of oak and Austria could probably send us more than in the past but as the price is high I do not expect much increase in the quantity

France Spain and Italy send us timber to the value of £693 173 which is valued at 18s 4d a load By far the greater part consist of pit timber which comes from the country bordering on the Bay of Biscay Here France has reclaimed, since the close of the last century, an area of some two million acres which used to be a waste of shifting sands and swampy ground. A large portion was planted with the cluster pine and from these woods we now receive considerable quantities of pit timber As far as I can judge this supply may continue, but it cannot increase beyond a moderate extent

As regards the receipts from Holland and Belgium, they represent a fraction of the timber imported by these countries

And now I come to the most important part of my subject, the supplies which we receive from the Baltic and from North America namely, Canada and the United States By reference to the figures previously given, it will be seen that we received in 1894 —From the Baltic, £10,376 491 , from Canada and the United States, £5,909 304 , making a total of £16,285,795. Here then, we have to do with the *bulk* of the imports into Britain, £3,552,477 coming from Canada, and £12,733,318 from foreign countries I shall first deal with the supply from the Baltic

Germany has sent us timber to the value of £992,779 Of the forests of that country 51 per cent are either state forests or under state control, and they are managed systematically, aiming at a sustained yield At the same time Germany imports already more timber than she exports Her population is increasing rapidly, and her trade expanding at a great rate, hence she is likely to require, within a reasonable period, every stick of timber which she produces At any rate, any export must be made good by a corresponding import from elsewhere

As to Russia Sweden and Norway it cannot be said, at present that the forests are worked with a view to a permanent supply You will observe that Russia sent us £3,970,000 of timber , Sweden, £3 977,000 , Norway £1 436 000 , making a total of £9,383 000

Of the Russian forests 60 per cent are said to be State forests of those of Sweden 20 per cent and of Norway 12 per cent The State forests are more or less under systematic management in Sweden and Norway, but the percentage is small In Russia matters are less advanced There seems to be no doubt that a falling off in the size of the timber is noticeable, which indicates that the accessible forests at any rate have been overworked Hence more distant forests, especially in Russia, must be attacked as time goes on and this will gradually raise the price per ton at which timber can be delivered in Britain, if it does not indicate a prospective decline of the quantity available for export Besides it must be mentioned that an enormous industry of the manufacture of paper pulp has lately sprung up, especially in Sweden, which uses small trees, in other words the trees which ought to replace those now cut for export as timber

As a consequence all the private forests in Sweden and Norway, and they form the bulk of the whole, are being rapidly reduced in material, and in Russia large areas of forest are every year sold wholesale for cutting

Again, the countries around the Baltic supply many other countries, besides Britain, with timber, such as Denmark, Holland, Belgium, France Spain, Italy Portugal, Gibraltar, Algiers, Egypt, Tunis, Morocco, Greece, Asia Minor, Cape Colony, Natal, other parts of Africa Australia Brazil and La Plata

I think I am within the mark when I say that the total exports from the Baltic are more than twice the amount which is sent to Britain All that timber represents the produce accumulated during the last century or two On the whole I have no hesitation in saying that the up-keep of the supply from the countries around the Baltic is considerably more than problematic What with cutting the matured trees for export as timber, and the young growths for the manufacture of paper pulp, stocks available for export must come to an end sooner or later

From Canada and the United States we have received : from Canada, £3 552 000 , from the United States, £2,357 000 ; total 5,909 000 is this supply assured to us?

With a view to answering that question, I shall first offer a few remarks about the the United States .—

I gather from a report drawn up by the head of the Forestry Division and signed by the Secretary of Agriculture, Washington, dated 10th February, 1896, that the forest area of the United States (exclusive of Alaska) has been placed at 500 million acres, and the annual consumption of wood at 25,000 million cubic feet, or 50 cubic feet per acre per annum. Such a yield can only be expected permanently from forests which are systematically and skilfully managed, and which are not over-run by forest fires. Considering that all these conditions are totally absent in the United States, it is clear that the people of that country take far more out of their forests than is made good by the annual new growth; in other words they are hurrying towards the exhaustion of their stock.

The seriousness of the situation has been felt lately, and on the recommendation of a special Forestry Commission, Mr. Cleveland has a few days before surrendering the Office of President declared an area of 21 000 000 acres to be State forest reserves. This added to previous reservations makes a total area of 39 000,000 million acres, which after all is less than 1 10th of the area required to supply the present population of the United States.

The above-mentioned report mentions further that the imports and exports of timber of the United States have just about balanced of late, so that country is not a genuine exporting country at all. As a matter of fact, it has made good its exports by imports from Canada, and this is the point which interests this country. The imports from Canada to the United States have increased most rapidly of late years. Whereas in 1889 of the timber exported from Canada 61 per cent went to Britain, and about 39 per cent to the United States, the position had been reversed in 1894, 40 per cent having gone to Britain and 90 per cent to the United States.

In fact the United States import already twice as much timber from Canada as they send to Britain. This process is increasing so rapidly that, after the lapse of a limited number of years the United States are likely to require every stick which Canada can spare under present conditions, thus threatening to cut our supplies short by some £6 000,000. And thus we have arrived at the Dominion of Canada. On reference to

Table III.

ESTIMATED AREA OF THE WOODLANDS AND CANADA.

Provinces.	Area of Woodlands in Square Miles.	Percentage of Woodlands to Total Area.	Population in 1891.	Area for Each Head of Population. Acres.	Revenue Derived by Government in 1893.
					£
Ontario ...	102,118	46	2 114,321	31	379,574
Quebec ...	116,521	51	1,488,535	50	178,353
New Brunswick	14,766	53	321,263	29	39,282
Nova Scotia ...	6,464	31	450,396	9	..
Prince Edward's Island,	797	40	109,078	5	..
Manitoba ..	25,626	40	152,506	107	...
British Columbia	285,554	75	98,173	1,885	15,196
Territories .	696,952	29	98,967	4,506	. .
Miscellaneous ...	.	...		.	31,381
Total	1,248,798	38	4,833,239	165	643,786

Table III., prepared from the Canadian Statistical Year Book, you will observe that the areas of forests in that country are given as follows :—

	Square miles
Ontario	102,118
Quebec	116,521
New Brunswick	14,766
Nova Scotia	6,464
Prince Edward's Island	797
Manitoba	25,626
British Columbia	255,554
Territories	696,952
Total ...	1,248,798

Here, then, you will think at first sight are areas sufficiently large to supply all our needs, besides making good the deficiency of the United States. On closer investigation, however, it will be found that a considerable portion of the area, though classed as woodlands, does not contain any marketable timber, and that the rest is by no means taken care of in such a manner as to secure a permanent supply of timber. On these matters Mr. George Johnson, the statistician of the Dominion, gives us much interesting information in his "Report on the Forest Wealth of Canada"—The forests of Canada contain a considerable number of species, such as firs, pines, larch, oaks, maples, plane, birch, hickory, ash, walnut, poplar, elm, etc Of these the three most important are:—(1) The white or Weymouth pine (*Pinus Strobus*) (2.) The spruces, especially (*Picea alba and nigra*) (3). The Douglas fir, or Oregon pine (*Pseudotsuga Douglasii*)

The white pine appears only in the south-eastern part of the Dominion, over an area of about 70 000 square miles Its timber used to be the principal item in the export, but not only the quantity but also the quality has fallen off Whereas the export in 1865 amounted to 606 300 loads it has fallen to 105 789 loads in 1893, being a reduction of 82½ per cent, although the average price rose during the same period from £1 a load to £2 16s.

Mr Johnson further shows, from measurement made at the ports of export, that the average size of the logs has fallen off by 30 per cent during the same twenty-eight years and he naturally arrives at the conclusion that the first-class quality white pine has nearly disappeared The question has been asked, whether the new growth will not replace what has been cut away On this point we have only the vague assertion that of the second quality pine there is a considerable supply From a recently published work by two American gentlemen, Messrs Pinchot and Graves on the white pine in Pennsylvania it appears that a reduction in size like that indicated by the above mentioned measurements corresponds with the increment of sixty eight years on the localities of middling quality, and of forty-four years on the very best localities

Even the most sanguine estimate put forward in Canada is to the effect that the existing stock of white pine will be exhausted in thirty-seven years, but from the data which I have given it is clear that this will occur very much earlier

Not only have the white pine forests been worked at about twice the rate of annual increment but for every tree which has been cut some ten or more younger trees have been killed by fire.

Turning now for a few moments to the spruce and Douglas fir, it should be stated that they appear over very extensive acres.

Enormous quantities of spruce timber are said to exist, but its cutting has also very much developed of late As regards Ontario it is stated that "its increasing use for the manufacture of wood pulp, largely for export, threatens serious inroads upon this valuable tree" Again in referring to Quebec "the spruce forests of Quebec are said to be very rich and extensive, and are being more and more exploited every year, adding a constantly growing proportion to the exports"

It appears that the spruce is gradually taking the place of the diminishing white pine, and that with lumbering and the manufacture of wood pulp, it is likely to share its fate as time goes on, at any rate within reasonable distance of the lines of communication

The Douglas fir has its home in British Columbia, spreading eastwards into Manitoba. It is the most important timber tree of that region, growing abundantly and to an enormous size on Vancouver Island, on the mainland shore, and in places extending inland. This tree is the main object of the lumbermen; besides domestic use, it is exported to the United States in rapidly increasing quantities, being widely known in commerce as "Oregon pine."

It is also exported to many other countries, and even as far a South Africa, where it is much used as pit timber. As regards this country, the Columbian timber is much less importance than that which comes from the eastern provinces of Canada, because the cost of transport is much higher. I have lately seen it stated that the freight came last year to 63s and 66s a ton which is nearly twice the amount at which fir timber can be laid down in British ports from the Baltic and Eastern Canada.

Owing to the rapidly increasing requirements of the United States however, I fear that this third great tree's existence is not on a safer basis than that of the others. At any rate I think I have said enough to show that the Dominion of Canada should take early steps to preserve this important article of export amounting to 25 per cent of its total exports. Let us see, then what Canada has done up to 1895 in this direction.

I do not think I need do more than shortly mention what has been done in Quebec and Ontario to check destruction and to assist the reproductive forces.

In the province of Quebec the legislature, by Acts passed in 1883 and 1889, has divided the province into twenty-one fire districts within which the Commissioner has the power to employ the necessary number of men to act in the suppression of any forest fires. For this purpose the Government has set aside the magnificent sum of $5,000 (£1,000) and the licence holders are obliged to contribute a similar amount to cover the expenses incurred.

As the total area of forest and woodland is given as 116,521 square miles each fire district comprises on an average 5,550 square miles, scattered over about 10,000 square miles, for the protection of which £95 are available every year. I need hardly say that under such conditions protection can exist only on paper.

In addition, licence-holders are prohibited from cutting pine trees measuring less than 12 inches and trees of any kind less than 9 inches on the stumps, but it is nowhere stated how this prohibition is enforced.

Ontario also, has a Fire Act, which empowers the Lieutenant-Governor in Council to proclaim fire-districts, within which fire from 1st April to 1st November, must be most carefully handled. For instance, for cooking, warming, or for any industrial purposes selection must be made of a spot with the smallest quantity of inflammable matter, which must be removed for a radius of ten feet.

Fire rangers have been appointed since 1885 and in 1891 there were 91 of these, which entailed an expenditure of £4 000. In some years, it is reported that no fires occured, but in 1891 there were bad fires.

A forest reservation and national park has been set spart in the Nipissing district called the Alaquin Park, but alas, two-thirds of it were already under licence, and on the remaining third the pine lumber was sold in 1892, so that this tract will not have the advantage of being a reserved forest under State management.

With all due respect to the Governments of these provinces, these measures can only have an infinitesimal effect upon the preservation of the forests, if they have any effect at all.

There is ample evidence to show that the measures of protection in Canada fall far short of what is wanted. Mr. Johnston, in his report, says:—

"A large portion of the forest has been divided (which I understand to mean that all the great trees have been cut out) by the lumbermen seeking for marketable timber. The careless torch has lighted fires like the Miramichi fire, which swept with fierce energy over an area of more than three million acres (4 700 square miles), leaving blackened giant pines to be a reminder, for more than half a century of the immense destruction there and then caused . . . . Vast acres have suffered from fire so severely, that in many places the soil has been burned off to the very rock; and a century's disintegrating force will have to act upon the rock before there can be soil enough created for practical uses."

In another place Mr. Edwards, M. P., said in 1893:—"It is safe to say, and I am sure that every lumberman in this House will bear me out in the statement that *ten* times the amount of forest wealth has been destroyed in Canada through forest fires, than has been cut by the lumbermen."

The conclusions which Mr. Johnston arrives at, in summing up the reports from the various provinces, are as follows:—

1. That the first quality pine has nearly disappeared.
2. That of the second quality pine there is a considerable supply.
3. That of other timber there is a large supply.
4. That Canada is within measurable distance of the time when, with the exception of spruce as to wood and of British Columbia as to provinces, Canada shall cease to be a wood-exporting country.

If these conclusions represent the actual facts, and I have no reason to think that they do not, then the Dominion of Canada is face to face with a very serious state of affairs which requires immediate and prompt action. There can be no doubt that proper forest conservancy should be introduced at a very early date, and before it is too late. This is necessary not only for the comfort of the present population, but also to meet the requirements of a future increase, and to satisfy the export trade in timber.

The matter is most urgent in the maritime provinces, where comparatively small areas are now at the disposal of Government. But even in Quebec and Ontario no time should be lost, as the difficulties will increase with every year which passes without action being taken, while in Columbia a great national industry may be preserved and immensely developed if early steps are taken.

And how should the Governments of the various provinces proceed? The answer is simple enough. Apart from the general supervision of the forests still at the disposal of Government, a sufficient area should under an adequate forest law be selected and constituted as permanent forest estates. These should be thoroughly protected against fire and unlawful cutting and they should be managed with a view to increasing production and a sustained yield, somewhat on the lines which have been followed in India. No doubt strong opposition would be offered to such measures, especially by those interested in the timber trade, but these difficulties can be overcome, just as has been the case in Burma, where the late Sir Arthur Phayre and Dr. (now Sir Dietrich) Brandis laid the foundation of a systematic management of the teak forests. Besides the measure is not so difficult to carry into effect as would appear at first sight.

According to the "Statistical Year Book" of Canada the total cut in 1893 amounted to 1 400 000 000 cubic feet for home consumption, and 600 000 000 cubic feet for export, making a total of 2,000 000 000 cubic feet. To secure this supply permanently an area of about 110 000 square miles is required, and this is after all equal to only about 9 per cent of the total area of woodlands, leaving 91 per cent for the ordinary lumbering operations. By way of further illustrating the matter I may take the case of the Provinces of Ontario.

Ontario has a forest area of 102 118 square miles. During the seven years (1887-93) the average annual cut on the Crown lands amounted to about 66 000,000 cubic feet yielding a value of £277,615. To yield this timber under efficient management an area of about 5 000 square miles would be required, which represents about 5 per cent of the total forest area, or 2½ per cent. of the province. The administration of these 5,000 square miles would cost about £35,000 a year, or 12½ per cent of the annual forest revenue. If an area of 10 000 square miles were declared permanent forest estates, thus securing double the present cut the cost would amount to £70,000, or about 25 per cent of the past annual income derived from the forests. There would still be a forest area of 92,000 square miles, where lumbering could go on as before.

Similarly, in Quebec 10,000 square miles might be declared reserves, leaving 106,000 square miles for the ordinary timber operations, and so on for the other provinces.

At the same time, these reserves would not be altogether closed against cutting, but that operation would be performed with due regard to the future yield capacity of the area, so as to step in and supply the country and the export trade at twice the present rate when the remainder of the forests commenced to give out.

The Dominion of Canada consists of a number of self-governing colonies, and it is not for me to say in how far the Home Government can influence that of Canada, but I am convinced that the matter is one of great importance The wages now paid in Canada for timber work are estimated at £5,000 000 a year, and the capital invested in the trade is given as £20 000,000 These are sums not to be trifled with, especially if it is considered that they might easily be doubled and trebled as time goes on, provided a sensible view is taken as regards perpetuating the supply of the raw material Indeed, Canada can become the great emporium for the supply of timber for the whole world in the same degree as other sources of supply fall off

Returning now to this country it is clear, on the whole, that future supplies of timber rest on an unsafe basis Most of the oak timber might, no doubt, be replaced by other hard woods, but this is out of the question as regards the pine and fir timber. The latter is now laid down on these shores at an average cost of £1 18s, 8d a load and none of the colonies except Canada can supply it at anything like that rate, even if they could grow the timber Hence the systematic management of a fair proportion of the Canadian forest is of the utmost importance to this country

But cannot we do something at home to assist in the production of timber? This opens out a question which would require a separate lecture for itself, hence I can only lightly touch upon the subject on this occasion The agricultural returns show that we have in Great Britain and Ireland mountain land and heath land used for rough grazing, 12,000 000 acres, land not utilised at present for agricultural purposes, about 13 000,0 0 acres; making a total of 25 000,000 acres Most of this land is, of course, used for shooting, and yields in this way, apart from rough grazing, a certain return but I do not see any reason why a considerable portion of it should not be put under timber It is said, in answer, that it does not pay to plant, but it is also easy to show that it will pay if the thing is done properly

If hitherto home-grown timber has not been able to compete with imported timber, the reason must be looked for in the following two facts.—(1) The home-grown timber is of inferior quality; (2) it comes into the market at irregular intervals and in fluctuating quantities. These drawbacks can, however, be removed by improved sylvicultural methods and a more systematic management of the forests, a subject with which I have dealt on various previous occasions. It is, indeed, easy to show that land which does not let for more than eight shillings a year—and there are many millions of acres—

can be more profitably used by afforesting it, even if all calculations were made with compound interest on the outlay The question of extended afforestation in these islands, and especially in Scotland and Ireland, has lately come more and more to the front, and the President of the Board of Agriculture has been approached on the subject of giving assistance The question then arises What can be done to stimulate the afforestation of surplus lands ?

The difficulties in the way are —

1st That afforestation requires a certain outlay at starting, and involves foregoing an income, however moderate, from the land until the woods commence yielding a return

2nd That a more complete knowledge of systematic forestry is required by those engaged in the formation and management of woods worked on economic or commercial principles

Hitherto these matters have practically been left to private exertions but since agriculture has fallen low, many names (including those of leading men of journals) have been calling upon the State for assistance, not only in this respect, but as regards industries generally

Although the proprietors of the land are those most interested in the matter, I think some assistance by the State is called for in this instance and it might be given in one and all of the following ways —

1 Assistance should be afforded for the equipment of forest schools, where economic forestry, as now elaborated by research, can be taught

2 The Crown forests should, as far as they are not required for other purposes, be managed on economic principles, so as to serve as patterns to private proprietors, and as training grounds for young foresters

This is a matter which has been urged by myself and others for the last 30 years It was gratifying to me to hear only a few days ago, that H M's Commissioners of Woods and Forests have at last made up their minds to do something in this direction.

3 Advances might be made to landed proprietors at 2½ per cent interest for the purpose of planting surplus lands, if they are unable to raise the money otherwise

4. Under certain conditions surplus areas might be acquired by the State and put under forests ; this would especially apply to the congested districts of Ireland

This budget of suggested methods of helping is not very formidable, and I think it is quite worthy of attention on the part of the Government A modest amount of help in the direction just indicated may :—

1 Produce a not inconsiderable benefit to agricultural interests

2 Help to secure a permanent supply of timber to these Islands

3 Be the means of keeping in this country a large sum of money, instead of sending it abroad every year, and

4 Last, but not least, provide additional work for the ever-increasing population of the country, help to prevent the continuous flow of population from the country into the towns where only too many are forced to swell the army of the unemployed.

India-Rubber and Gutta Percha and their Sources.

From *Nature*

The question of the supply of India-rubber to meet the present enormous demands caused by the progress of electrical science, and the rapid development of the application of the substance for cycle and carriage tyres, is one that has been much discussed of late, and continues to increase in interest. For sometime past it has been well known that the trees which supply the best rubber known in commerce namely Para rubber have been more difficult to get at in consequence of the collectors having to proceed further into the forests in search of the trees (*Hevea brasiliensis*) which yield the valuable juice. But though greater distances have to be traversed in order to collect the rubber there seems but little fear of the absolute failure of the rubber supply generally or of this one particular kind. Though the quality of this rubber is of a very superior nature, we are fortunately not dependent alone upon it for the supplies of our markets for from the East and West Coast as well as from Central Africa and also from India and the Far East, we obtain very respectable quantities, indeed, the resources from tropical Africa in this respect have of late so much increased that they promise to compensate for any loss of the American supplies, and the experience of the past year or so, when a new source of rubber has been discovered at Lagos is even more re-assuring as to the future supplies, for other plants may yet be found capable of assisting in furnishing a substance that will probably, in the future, be in still greater demand than it is even now. So that it has become necessary for every one interested in this peculiar industry to take every precaution to prevent waste of material, both in the processes of collecting the milky juices and in the preservation of plants yielding them.

It seems pretty certain that, whatever takes place in the discovery of new sources, the plants yielding these elastic juices must belong to one of three natural orders, for all the known plants furnishing rubber of commerce belong to the Euphorbiaceæ, the Urticaceæ, and the Apocynaceæ, as will be seen from the following summary.

Euphorbiaceæ (*Hevea brasiliensis*). This is the source of the Para-rubber already referred to, and the plant from which the earliest supplies of rubber were obtained when, in 1770, it first appeared in London as a new discovery for rubbing out pencil marks on paper, and realising about three shillings per cubic inch. At the beginning of the present century it began to be used in the treatment of woven fabrics, for air-tight and waterproof articles. So rapidly, indeed, did its use develop, that in the year of the Queen's accession, Para rubber was imported into England to the amount of 141 735 pounds, and twenty years later it had increased to 3 477,445 pounds, while at the present time, when the trade returns are counted by hundredweights instead of pounds, the import accounts for 1896 showed the total of rubber from all sources to be 431 164 cwts which were valued at £4 993,186. The species of Hevea of which *H brasiliensis* is the best known as a rubber producer are large trees growing abundantly in the humid forests of tropical America especially along the Amazon and its tributaries. As in most of the Euphorbiaceæ, the wood is soft and easily cut in the tapping process. The trees are locally known as Seringas. *H brasiliensis* grows to a height of 60 feet, branching from the base. The collection of the milk commences about August and is continued till the following January or February. In the wet season the milk is too watery to produce good caoutchouc. The trunk of the tree is wounded with a knife or a small axe-like instrument, a deep horizontal cut being first made a few inches from the base, and a vertical one from this, some distance up the trunk; oblique cuts are then made into this main channel, which conveys the milk into small clay vessels placed at the bottom to receive it. As these are filled they are emptied into a calabash or gourd and when this is full it is carried to a more convenient place for coagulation; for this purpose the contents of the calabash are emptied into a large earthenware basin. A kind of wooden paddle, with a widish blade and a long handle, is then dipped into the milk and turned about over the smoke and heat of a fire made of the hard bony fruits of *Maximiliana regia* or *Attalea excelsa*, which fire is enclosed with a thick earthenware covering, open at the top, like a small chimney, to allow the heat and smoke to escape. As the rubber coagulates upon the blade, in the form of a thin film, more milk is poured over it and the same operation of holding it over the fire repeated. This goes on till a sufficient thickness of rubber is deposited, when it is cut through round the edge, and the paddle withdrawn. Various kinds of Para rubber are thus prepared and are known in commerce under different names, according to the thickness of deposit. The large round balls, generally known as ' Negro head" are made up of scraps of rubber tightly rolled together. This kind is often much adulterated and one specimen in the Kew Museum contains in the centre, as shewn when cutting the ball through, about one-third its weight of pieces of brickbat and cotton cloth

Besides the process here described, some para rubber is coagulated by the aid of alum, and by other means; but the quality of the rubber from this source is always good So far back as 1873 the necessity of securing supplies of rubber for future generations, occupied the attention of the Kew authorities, and living plants of *Hevea brasiliensis* were sent to India with the view of establishing the plant in that country Smaller consignments were also made to the West Coast of Africa, Jamaica, Dominica, Trinidad, Queensland, Singapore, and Java. The history of this important undertaking is fully recorded in the Reports of the Royal Gardens Kew, for 1873 and subsequent years, where indeed, will also be found recorded the various experiments made by Kew in the introduction of other rubber-yieding plants into countries that were thought suitable for their extension

Another rubber-yielding plant of the Euphorbiaceæ is that which furnishes the kind known as Ceara Scrap, from the fact that this kind always appears in Commerce in masses composed of agglomerated scraps The plant is a native of Central America and is known to botanists as *Manihot Glaziovii* In 1876 a large quantity of seeds and plants of this species were collected in Central America and brought to Kew they were rapidly propagated, and plants were sent to Ceylon Singapore, Calcutta, and other places in most of which the plants grew rapidly and yielded rubber, thus proving their capability of establishing themselves in their new homes

Urticaceæ —In this order we find also a Central American rubber plant in *Castilloa elastica*, which with perhaps some allied species, furnishes the Commercial kinds known as Guatemala, Mexico, and West India rubbers *C elastica* is one of the species that has received much attention at Kew, and in 1876 was widely distributed. The Indian source of rubber (*Ficus elastica*) also belongs to this group of plants The plant is so well known as a parlour plant in this country, producing its fine glossy leaves under almost any conditions, that the fact is scarcely realised that in India and Ceylon it produces a veritable forest of trunks and covers the ground with its long-stretching buttresses or roots, which run sometimes for distances of 30 or 40 feet It is the source of Assam rubber which is collected by wounding the stems and buttresses in all directions The milk is collected either in holes made in the ground or into leaves folded in the form of a vessel to receive it On the upper parts of the stems, or on the branches, the juice is allowed to coagulate by exposure The largest yield is obtained in August, when on an average, a tree will give about 50 ozs of milk, yielding about 15½ ozs of pure rubber. To prepare it for market it is sometimes poured into boiling water and stirred until it is sufficiently firm to be carried about without sticking together. It is shipped from Calcutta in baskets made of split rattan and mostly covered with a gunny bag. When cut, the rubber has a mottled appearance, and is composed of pieces varying from cream or flesh colour to a bright pink or even red. It is either in the form of separate stringy-like balls, irregular blocks, or large masses. Another species of *Ficus*, namely, *Ficus Vogelii* furnishes one of the kinds known as Lagos rubber. The tree is known in West Africa as the "Abba" or "Abo," and is fully treated of in the Kew Bulletin for 1888, page 253, and 1890 page 89. The quality of this rubber was never considered very satisfactory, as it was more or less resinous, and was consequently used for mixing with other kinds rather than by itself. Another kind of Lagos rubber has however, since been discovered, which has proved to be of superior quality and is next described.

Apocynaceæ.—To this order belong the several species of Landolphia climbing branching shrubby plants supporting themselves on the surrounding trees of the forest. The stems of these plants average from 4 to 6 inches in diameter and the principal species furnishing what is commercially known as African rubber are *Landolphia owariensis*, *L. florida* and *L. Kirkii*. The quality of these rubbers though mostly good, is by no means equal to the Para kind but the discovery of a new source of Lagos rubber, from a tree known to the natives as the Ire or Ireh has given a great impetus to the trade of the West Coast of Africa in a rubber of extremely good quality. The *Kickxia Africana* unlike the species of *Landolphia* forms a tree 50 to 60 feet high with a trunk averaging 12 to 14 inches in diameter. It is said to be one of the most beautiful trees of the forest and is capable of producing in a good season as much as from 10 to 15 ℔s of rubber per tree. For the purpose of extracting the rubber a deep vertical cut is made through the bark and several oblique cuts on each side running into the main channel at the base of which a vessel is placed to receive the exuding milk which is coagulated by allowing a quantity to stand for some days in a cavity made in the trunk of a tree so that the watery portion evaporates or soaks into the wood, leaving the solid portion behind which is kneaded and pressed together into a solid mass, or the milk is placed in a vessel and boiled, the rubber beginning to coagulate almost immediately the heat is applied. The whole history of this interesting discovery and development is given in the Kew Bulletin for 1895 page 241, and 1896 page 76, from which we learn that in January 1895 which practically marks the beginning of the industry, the exports were 21,131 lbs valued at £1 214 and at the end of December of the same year this had increased to such an extent as to show a total for the twelve months of 5,069 504 lbs, of the value of £269 892-13*s* 10*d*.

As the Bulletin remarks: 'The history of this new rubber industry in Lagos is full of interest, and illustrates the wonderfully rich resources of the vast forests of West Africa. It shows also very clearly how largely these resources can be developed by judicious and intelligent action on the part of the Government.

Besides the important sources of the rubbers already mentioned, there are still others belonging to the same natural order *Apocynaceæ*, natives of the Far East, which may be briefly referred to as species of *Willughbeia* and *Leuconotis*. *Alstonia plumosa* yields a rubber in Fiji, whilst *Forsteronia floribunda* and *F. gracilis* yield rubbers in small quantities in Jamaica and Demerara respectively, though not in sufficient quantities to be of any commercial importance.

From the foregoing list of plants, it will be seen how generally distributed the elastic juices are in Apocynaceous plants.

Space will scarcely allow us even to mention the allied substance gutta percha, the history of the introduction, development and threatened failure of supply of which is fraught with so much interest and warning. How that in 1842, the substance was first discovered in Singapore and the trees cut down in such large numbers to supply the European demand, that in five years after, only a few trees existed in Singapore and a similar fate attending the trees which were afterwards found in Penang, are facts that are well known as applying to *Dichopsis gutta* a sapotaceous tree, upon which the reputation of gutta-percha was at first founded, and from which the bulk of the commercial supplies have continued to be drawn, though it is more than probable that a similar substance is yielded in the East by allied trees, the botany of which, however, is but imperfectly known.

A substance very like gutta-percha is furnished by *Mimusops globosa*, a large forest tree, growing to a height of from 60 to 70 or even 100 feet, in Trinidad, Jamaica, Venezuela, and British Guiana. It belongs to the Sapotaceæ, and the solidified milk, or gutta, was first brought to this country in 1859. Its use with us has fluctuated very much and it cannot be looked upon as a perfect substitute for true gutta-percha.

The interest at the present time is much greater towards the rubber supplies than those of gutta, and this is borne out by a few facts referring to the probable demand, in the very near future, that have appeared in a recent number of our contemporary, *Commerce*, among them being a statement that the estimated outturn of cycles in Great Britain and the United States during the present year will amount to 1,750,000; besides this, there is the probable development of motor carriages, and the extended application of rubber for the tyres of ordinary vehicles. So that there is every probability that the interest in rubber-yielding plants will go on increasing.

JOHN R. JACKSON.
MUSEUM,
Royal Gardens, Kew.

Death rate in the Indian Forest Department.

The *Pall Mall Magazine* for December 1896 contained an article entitled "Despatches," in which it is shown that during the 30 years from 1866 to 1895 the average annual death rate amongst the population of England and Wales was 20 6 per mille A table was also given headed When people die" from which it appeared that out of every hundred deaths which occur 23 6 are amongst people between the ages of 21 and 55 years Therefore during the 30 years from 1866 to 1895, amongst people between the ages of 21 and 55 the average annual death rate may be calculated to have been 4 86 per mille Let us see how these figures compare with the mortality in one of our Indian departments In the year 1867 the first Forest Officer trained in England was sent out to India Since then up to the end of the year 1894 119 young officers have come out from England Of these 19 have died The total service of the 119 officers amounts to 1,204 years *i e* the average length of service is 10 1 years Nineteen deaths out of a total of 119 men during the average period of 10 years shows us that during the past 30 years the death rate amongst Forest Officers in the Bengal Presidency has been 15 75 per mille as against 4 86 per mille the rate prevailing in England and Wales during the same period Moreover at the end of the year 1894 only five of the trained officers were over 45 years of age a fact which renders the comparison even less favourable During the same period the death rate amongst Forest Officers in Burma has been 18 per mille and in Bengal 22 7 per mille It is evident therefore that men in the Forest Department are exposed to exceptional risks, and that the small concessions in the matter of their pensions for which they are now agitating might well be granted to them It would appear that by doing so, no great danger of unduly swelling the Pension List would be incurred, for out of 129 officers trained and untrained, who have left the department, only 33, or 25 per cent, have earned a pension at all —*Pioneer*

VII.—TIMBER AND PRODUCE TRADE

The Moulmein Teak Market.

Messrs Ferd Foucar, & Co, favour us with a comparative statement, showing the exports of timber from Moulmein for the past fifteen years up to 31st December, 1896 The official returns in connection with teak round logs, taking the official year up to 31st ulto, compare as follows —

		Logs		1896	1895	1894
Stock in depôt		27 100	agst	36 591	58 960	57 190
Entd	Since Ap 1 1896	114 123	,,	106 285	132 031	128 864
Clrd		122 614	,,	129 660	130 255	130,678

The present stocks are the smallest ever known, and they contain a very poor proportion of timber likely to be suitable for export to Europe, nor are converted stocks of the latter quality large. Prices at Moulmein have reached a quite unprecedented high level, and there is no prospect of their getting easier just yet—on the contrary.—*Timber Trades Journal*

Comparative Statement of Exports of Teak Timber for the Past 15 Years—December, 1896-1882.

		Europe	Mauritius and Cape &c.	Calcutta	Bombay and Kurrachee	Madras and Coast	Coastwise	Straits and China	Total.
Exports for December, 1896		432	20	2,002	943	151	324		3 872
Previously this year		14,686	303	25,997	26 094	5,511	5,004	100	77 695
Exports from January 1 to December 31,	1896	15 118	323	27 999	27,037	5 662	5,328	100	81 567
„ „	1895	18,172	1,752	32,068	27,093	6 798	3,812	404	90,099
„ „	1894	16,877	1,075	29,277	34,172	11,915	4,734	212	98,262
„ „	1893	13 195	718	28,809	32 946	7 062	6,828	326	89,884
„ „	1892	19,407	658	20 278	43 090	8,550	4,379	192	96 554
„ „	1891	11,353	863	22,330	20 494	12,007	3,245	104	70,396
„ „	1890	15,145	516	26 566	18 766	9,778	2,873	388	74,332
„ „	1889	31,921	1,187	24,120	29,367	9,775	5,375	356	102,101
„ „	1888	33,254	641	24,240	3' 521	8,749	3,842	376	103,623
„ „	1887	14,969	203	25,774	48,198	13,041	8 802	355	111,342
„ „	1886	12,288	1,397	18,677	54,093	14 120	2 079	216	102,870
„ „	1885	29,628	1,560	20 031	45,917	12 283	3,059	148	112,626
„ „	1884	23,812	526	25,428	25 249	18 142	3,721	339	97 217
„ „	1883	22,077	1,664	29,445	30,660	8,707	4,429	672	97,654
„	1882	38,175	1.238	33,232	28,056	12 181	4,998	938	118,820

Churchill and Sim's Circular.

4th May, 1897.

EAST INDIA TEAK.—The deliveries for the first four months of this year amount to 6,756 loads, against 7,181 loads, in the same period of 1896. In April they were 1,668 loads, as compared with 1,425 loads in April last year. For any stock now on this side, prices have kept very firm, but the market for forward cargoes has not been quite so active. The general demand for the wood has expanded, and a continuance of this demand may be expanded; but the high prices obtainable have encouraged shipments of timber inferior to the usual European quality, which has tended to make buyers suspicious of importing floating cargoes.

ROSEWOOD.—EAST INDIA.—Small lots find ready buyers at good prices.

EBONY.—EAST INDIA.—The parcels lately landed have been sold at a satisfactory price, and further shipments of good wood may safely be made.

SATINWOOD.—EAST INDIA.—*Figury* wood in either *logs* or ***boards*** sells well; but for plain wood there is only a very limited demand.

PRICE CURRENT.

Indian teak	per load	£11 10s.	to	£16 10s.
Rosewood	,, ton	£8	to	£10
Ebony	,, ton	£7	to	£8
Satinwood	,, sup. foot	8d.	to	12d.

MARKET RATES OF PRODUCE.

Tropical Agriculturist, 1st May, 1897.

Cardamoms	per lb	**3s. 6d.**	to	**3s. 9d.**
Croton seeds	per cwt.	**85s.**	to	**86s.**
Cutch	,,	**31s. 3d.**	to	**32s. 6d.**
Gum Arabic, Madras	,,	**37s. 6d.**	to	**45s.**
Gum Kino ,,	,,	**£45**	to	**£55**
Indiarubber, Assam	per lb	**1s. 9d.**	to	**2s. 4d.**
,, Burma	,,	**1s. 4d.**	to	**2s. 1d.**
Myrabolams, Bombay	per cwt.	**4s. 3d.**	to	**8s. 6d.**
,, Jubbulpore	,,	**4s.**	to	**7s.**
,, Godavari	,,	**3s. 9d.**	to	**5s. 6d.**
,, Calcutta	,,	**4s.**	to	**6s.**
Nux Vomica, Good	,,	**7s.**	to	**7s. 6d.**
Oil, Lemon Grass	per lb	**2⅝d.**		
Orchella, Ceylon	per ton	**10s.**	to	**12s. 6d.**
Sandalwood, logs	,,	**£30**	to	**£50.**
,, chips	,,	**£4**	to	**£8.**
Sapanwood,	,,	**£4.**	to	**£5**
Seed lac	,,	**70s.**	to	**80s.**
Tamarinds	,,	**7s.**	to	**8s.**

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Shade, Cover, and Shelter.

The term "cover" is in frequent use as also are the words "shade" and "shelter" in a more or less indefinite sense. "Cover" and "shade" have their definitions in our books, but hitherto the tripartite degree of precision has perhaps not been clearly seen. In fact it is not always possible to differentiate the effects which fall under the above heads but nevertheless they are in many important cases capable of individual recognition. It is to be recommended then that in alluding to these matters, foresters should first ascertain precisely whether they mean "shade," "cover," or "shelter" and speak accordingly. M. E. Guinier has contributed to the Revue des Eaux et Forêts his conclusions on the subject, and for the benefit of our numerous readers who have not access to them in original, the more important points, and others more nearly concerning us are touched upon below.

First, then, the definitions. A definition is to an idea much the same as a crystalline form is to a mineral. It happens frequently that the idea and the mineral, though quite distinct and recognisable, have no crystalline form, which fact is, perhaps, on the whole, something to be thankful for, as encouraging reason versus cramming.

Cover is the existence, and action, of a more or less opaque screen between the soil and the zenith. Its effects are seen within the horizontal projection thereof on the soil, that is to say vertically beneath every part of it.

Shade is the action of a more or less opaque screen interposed between the sun and the soil or plant. The shadow of this screen moves with the sun, and its effects vary according to the time during which, and the direction from which, direct sunlight can pass it.

Shelter is the action of a screen more or less impermeable, and more or less extensive, placed between the plant or soil, and the horizon or other part of the sky, at a distance sometimes considerable

In its widest and most general sense, the term "shelter" includes the other two, which are only particular cases thereof.

I —*Cover.*

Cover, if complete, is always harmful It would be impossible to grow plants under a solid wooden roof large enough to prevent access of sidelight, and even under a dense high forest it is found that the underwood is little or none

Certain plants can accommodate themselves to sidelight only, but others (*e g* mignonette, indoors) can not

The action of cover is thus greatly dependent on its area, which limits the amount of lateral light that can obtain access. An isolated tree frequently does little or no harm, while a dense high forest only allows any undergrowth to appear in the richest and most fertile spots Over crops of corn, &c if the soil is good and the trees tall and scattered, little harm results, either to the quality of the crop or to its ripening

The action of "cover" is modified by the degree of moisture in the air, for the following reason Sunlight is of two kinds, direct and diffused the latter being the light reflected in all directions by the atmosphere, by the particles of moisture, by the dust floating in it, &c. The presence of mist or of thin films of cloud, may even as much as quadruple the light, not indeed of the sun, but that of the sky in general, since the direct rays are impeded and absorbed. This diffusion of light attains its maximum in an air saturated with moisture on the point of condensation Foresters in this country will surely be able to remember days when the sun was veiled, but the sky so intensely bright that the eyes were dazzled more than by the direct sunlight itself

Moisture in the air affects also the heat, since both in the invisible and in the visible (mist) state, and especially at night, it intercepts the heat radiating from the soil, and so prevents the lower layers of the atmosphere from becoming cold An important consequence is this, that in moist places or countries, whether foggy or clear, the layer of air in contact with the soil is warmer than is the case in dry climates This is the case even under the cover of a High Forest

The gases emanating from the soil, the scents of flowers, resinous vapours, &c, often appear to influence heat more even than does the moisture The stifling heat of a pine forest on a hot summer day is probably due to the vapours of resin.

The special effect of a moist atmosphere is, that the light varies less, as from cover to open ; there is less difference between the light under "cover" and the light in the open, than in dry climates. In a moist atmoshpere, protected from direct sunlight, the differences between the temperatures communicated to the soil and to the plants are less extreme and the temperature of the air in general is more equable

In misty or foggy climates, the injurious action of "cover" on the vegetation is further diminished by the fact that the chemical or actinic rays which form part of all sunlight, are present in greater relative abundance in a weak light, and are very plentiful in diffused light

It is true that the air contains more moisture as the equator is approached but it is much more thoroughly in solution, so that in fact the most cloudy skies and misty climates are found under more northern latitudes for example northern France and Germany In such climates other circumstances being equal, the light under the cover of high forest is relatively greater than the average, and the warmth of the soil is better preserved than usual. It is a mistake to say that the absence of mist by intensifying the brilliance of the light permits light demanding species to survive under cover to a certain extent

The above explains the fact that in northern climates such as Norway, the broad leaved species give a more dense shade and cover than the same trees further South It also explains why certain species (*e g* birch), extreme light-demanders in France and Germany can yet bear a certain amount of cover in Norway

The fact is that the climate being more misty, the light is more diffused and thus penetrates more easily under the cover, causing buds to develop more easily in the interior of the crowns, and lower branches to remain green longer M Guinier goes so far as to say that the conception of the classic seed-felling called "close" or *coupe sombre* could only have arisen in such a climate (N. Germany) where the influences above considered enable young plants to survive and develop under an amount of cover that would be soon fatal to them in a brighter and drier clime

There are other ways in which the action of 'cover' is hurtful, for instance by preventing the formation of dew and the access of light rain to the soil More fanciful perhaps are the effects resulting from the green colour of the light filtered through the crowns (green being a color unfavourable to vegetation) and the problematical abstraction of electricity by the dominant species.

"Cover' has also its utility It protects against too much insolation those species which can live under another It prevents too rapid transpiration It avoids sudden and violent chills at night It improves the soil by assisting decomposition and keeping it in a light and moist state undeteriorated by sun and wind

II —*Shade*

Shade, whether produced by trees, hedges, walls, or near hills, is not harmful as a general proposition, for there is a large class of shade-loving plants which absolutely require a shade more or less dense and more or less enduring. Shade is hurtful to agricultural crops, to market gardening, and to the growing of fruit and flowers subject to a few exceptions which require a small amount of shade. In forestry, shade is considered generally an advantage but with a certain degree of reserve. Shade moderates transpiration mitigates insolation, diminishes evaporation and preserves the freshness of the soil to a considerable extent, while it prevents neither the deposition of dew nor the access of light rain, nor does it interfere with the functional activity of the chlorophyll. It may on the contrary assist this latter, which is sometimes hindered by too strong a sun. In short shade is hurtful or beneficial only according to circumstances, as may be seen plainly in any forest nursery. Sometimes a bed of plants in the open is killed off while a bed that happens to be shaded for an hour or two in the day may thrive. Sometimes the growth of the plants is seen to vary directly as their distance from a hedge or bank or other shade producer the level of their crowns producing a perfect inclined plane. Sometimes the young plants put out in a blank will prosper only round the borders sometimes only in the middle. The former is sometimes markedly the case with *Sal*.

The shade of standards over coppice appears generally favorable to the stoolshoots but in this, as in most other cases it is difficult to separate the benefit derived from shade and that derived from shelter.

III.—*Shelter*.

Shelter when it involves neither shade nor cover, is always beneficial whatever the crop affected, but especially in the case of fruit and flowers. Sheltered positions are generally rich in species. Even natural forest growing in difficult conditions, can only subsist in sheltered situations. Shelter indeed modifies favorably all the conditions of local climate, sometimes even altering it completely. There are two kinds of shelter. As we have geographical climate and local climate, so we may have geographical shelter and local shelter.

Geographical shelter depends on the configuration of the soil, and especially on the existance of high mountains.

Local shelter depends on the minor elevations and depressions of the soil, small spurs and ravines, and on the works of man himself, such as hedges, lines of trees, walls &c.

Geographical shelter acts by reducing the strength of the wind or changing its direction and its temperature, and consequently that of the soil. It also influences the conditions of storm, rain, and fog. In cold climates, shelter from the north wind is desirable. In hot dry climates, shelter from the south may enable vegetation to exist where otherwise would be bare rock. The vine for instance, about Grenoble is hardly cultivated at a greater elevation than 1,600 feet, while in the valley of the Durance, vineyards are found at nearly 4,000 feet. The same conditions affect the forests also and probably to an even greater degree Even when the mean temperatures are the same there is a great difference in the solar radiation at high and low altitudes especially if comparison is made between a high situation in the South, and low one in the North In the mountain, the air is dry, fogs are rare the number of clear days is greater, and the sun's action is both stronger and more prolonged Hence the vegetation is more active and the plants get through their development in a shorter time One effect of shelter is the limitation of the sky area towards which radiation can take place and the consequent diminunition of the nightly cooling to which the sheltered spot is subject

Another effect lies in the radiation which it receives Suppose a spot sheltered from the North by a high slope This slope receives the sun's rays more or less at right angles to its surface, and so reflects back a large proportion of them on to the place sheltered by it If sheltered from the South, it would be by a slope facing North, which could possess no great heat to add to that received directly from the sun In general terms the East is the aspect most favorable to vegetation, the South and West the worst, but it must never be forgotten that the local has a powerful influence on the general and may in some places nullify it completely

The action of wind is always inimical to vegetation, not only by the excessive evaporation and cooling which it causes but by its mechanical action which produces crooked stunted, distorted stems and branches together with heart shakes, ring shakes and other evils These effects can be seen anywhere along the seashore and on exposed crests and ridges Remarkable exceptions to this rule are found in the [illegible] always erect sturdy, and dignified and to a less degree in the Lombardy poplar which is never known to grow crooked though it is indeed not subject to such violent trials as *Pinus cembra* Constant and violent winds leave their impress on the trees which are not only all sloped in the same direction, that of the wind, but show many dead branches on the exposed side, and possess trunks not circular but oval (not elliptical) in section, the thick end of the oval being on the sheltered side

Local Shelter The Indian peasant, and the large landowner are agreed in waging war to the knife against all trees growing round or scattered in their fields, unless prevented by the fact of those trees being royal," or Government Even then the trees lead a sometimes precarious existence The reason is, to a small extent, the desire of gain, and the need of wood for household purposes, but chiefly the destruction is due to a belief that the presence of a tree, or even a hedge injures the crop In Europe, on the contrary, it is generally recognised that fields sheltered by rows of trees are more productive than those that are not so sheltered, and when the demand for wood has exterminated the trees, it is not uncommon to find farmers sheltering their fields on the exposed side by fences of different kinds The exposed side of course depends on the danger, frost, dry winds, scorching sun, whatever it may be, in conjunction with the demands of the crop The shelter given by a wall, tree, ridge, etc extends to a distance of 10 to 20 times its height At high elevations, the upper borders of the forest should be preserved with the most extreme care the trees once removed whether by abuse of rights or by accident, can never be replaced, and there is a phenomenon only too familiar which may be called the *lowering of the forest zone* The upper shelter once gone exposes a lower band of forest which is unable to resist the new conditions and disappears This again exposes another band which disappears likewise, until the forest limit descends to a level where it can subsist without shelter An article, published sometime ago, referring to this subject mentioned known instances in which abusive grazing had lowered the upper edge of the forest zone by (if memory serves) 1,000 to 3 000 feet The graziers themselves would perhaps not make the least pretence of regret the grazing lands lying mostly above the forest but every forester knows what it means to have another 1 000 feet of bare steep slopes exposing the country below to all the dangers of landships, torrents, avalanches, an increased severity of climate

Is shelter ever harmful? There are two cases in which this may occur Occasionally a place is found sheltered from the South, when all it happens to want is a little more sun Frequently places are found where plants are habitually killed off by frost, though the surrounding slopes suffer in no such way These are well known, and consist of valley bottoms small depressions, and little level places where the plants put out are killed back year after year till they attain a height of 6 to 15 ft as the case may be in the locality, when they are safe The reason of this danger lies in the fact that such places are more moist and more protected from wind , it is the presence of moisture (which would be carried off by a breeze that constitutes the danger of frost Another reason doubtless acts to some extent, namely the gravitating of the coldest (*i e* heaviest) air to the low levels and depressions where it can effect a lodgment There are certainly other reasons, for this question of local frost is not completely understood

IV —*Minor flora*

The minor flora found in a forest differs in the same locality according to the density of the shade and cover, Under a very dense cover, such as that of a young spruce crop, there is absolutely nothing to be found, unless a few fungi, lichens, and perhaps a moss or two As the cover becomes less, a few phanerogams appear and the list increase with the light, until the forest, consisting of scattered trees only become a perfect paradise for the botanist

V.—*Regeneration.*

How are the seedlings produced under cover? How do the young plants develop? That is to say, what are the conditions of regeneration of a given species? These are the questions which claim the attention of every forester, and cannot be urged too frequently. Practically every forest species scatters every year a certain amount of seed. What becomes of it? Are seedlings found to correspond? In some cases can even a single seedling be found? Can we even say that we know by sight the young seedling of every species? Can we tell when and where to look for it? How to obtain it? How to treat it when obtained? A few eminent foresters may consider these questions derogatory to their dignity. To such they do not apply, but let them serve to point out a wide sphere of usefulness to those in search of a direction for the better exercise of their energies.

Suppose we have a good crop of seedlings under a silver fir forest which is to be regenerated. Do we think we have got what we want, and proceed to clean-fell all the mature trees, rejoicing? Or, do we proceed to make a careful selection felling, and yet another and a third, watching the result with some anxiety, and taking 10 or 20 years over it?

In a chir forest naturally open, when regeneration is wanted, we clean out half the stock or more, straight away, and the rest follows five or six years after. Why this difference? Because trees have different temperaments and requirements which are classified as "delicate" or shade-enduring, and "robust" or light demanding. But having provided these two labels, we must not imagine we know all about their use. Some trees will require both at different periods, others will not be fitted with either, and others, it must be confessed, have not been properly measured yet. A great deal, (but yet far from everything) is known about teak, deodar, spruce, sal, blackwood, babul, &c. but of how many of the important auxiliary species can the same be said? Referring to babul, it is sometimes alleged that it will not grow on a calcareous soil. Any forester able to quote actual instances of a good crop of babul growing on a soil calcareous proper, would be doing a service. Such instances should be easily found in Sind, and elsewhere.

In so far as concerns the power of resistance to the solar rays, it may be said that nearly all trees are at first, for a very variable period, and to a varying extent, "delicate." In fact, instead of asking whether such and such a tree is robust or delicate, we might almost as well ask *when it began to become robust.* To take deodar for instance, it is well known that for the first year or two, or three, the plant is decidedly delicate, becoming less so for the next ten years or so, after which it is as robust as can be desired, for we find it, densely branched to the ground, crowning dry ridges and pinnacle rocks in solitary and sturdy grandeur. Young plants that are of a somewhat herbaceous habit, and those that are naturally slender, are generally delicate, but others (*e. g* silver fir) remain so long after the period of lignification has set in. Some young plants, while still appearing slender, will become robust within a few months of germination. There is a certain relation between the density of the cover of a given species, and the temperament of the young plant The law of the survival of the fittest makes it evident that this must be the case for some of the dominant species, but what about those species which may be called "opportunist,' auxiliary and accessory species, even minor principal species, that seldom form the mass of a forest, but have to come up, survive or perish, just when and where they can? For these, there is no such law, and they form the majority. The spruce is an exception to the general law, its seedling is less delicate than that of the silver fir, while its cover is more dense. The difficulty is solved by the lightness of its seed, which is carried beyond the actual cover

But the sun is not the only danger Plants that can endure the sun are called robust, when they are frequently, from some other point of view, not so, being perhaps very susceptible to frost. Other dangers frequently fatal to plants are, a dry soil a hot dry atmosphere, (quite a different thing from direct solar heat), wind, &c

A list of plants drawn up in the serial order of their frost-endurance would differ totally from a list drawn up in serial order of sun-endurance The question of shelter during regeneration thus demands the careful consideration, not of one only, but of all these points

Too much stress cannot be laid on the utility of scrub and undergrowth, and especially of thorny bushes, in regeneration In Europe they say ' The thorn is the cradle of the oak,' in this country it might almost be said that the thorn is the cradle and protector of everything The right of removing thorns has been granted by Government in many places, doubtless after due consideration, but the removal of such thorns means the removal of the last hope of regenerating a soil trodden hard and grazed bare all around, and on which the standing crop is steadily degenerating and diminishing under the constant unpunishable "petty offences," a branch broken here, a slice of bark removed there, and the regular fires for which no responsibility is enforced on the privileged classes who cause them To take sandal wood for instance, a timber so valuable as to be sold by the pound, the seed germinates freely, flourishes awhile, and disappears , yet the tree is robust and grows on dry and rocky soil Why? Because the thornbush is the cradle of the sandal Those trees that survive have in most cases had the good fortune to arise from the seed that fell among thorns, all the rest were scorched up or eaten

The question of soil is naturally a most important one. A soil trodden by cattle into something like a sheet of rolled iron, cannot be expected to bristle with seedlings. A dense mat of grass roots a foot deep is neither very encouraging. With these exceptions, most conditions of soil may be expected to allow the germination of seed to a fairly satisfactory extent. The existence of even a rather dense crop of herbaceous plants and shrubs is usually rather an advantage than otherwise.

It may of course be argued, by advocates of popular privileges, that we are allowed to keep closed a fourth or fifth of the forest for regeneration, which is sufficient, and we have no right to expect more in the shape of *advance growth*. But most foresters will agree that advance growth is not merely a blessing, but practically a necessity, unless we are to see the forests deteriorate under our care Take a coppice with standards at a 30 years rotation Seven coupes may be kept closed *nominally*, but in practice the breach of closure is too frequently, at any rate in Bombay, a "petty offence," and so far from the offender being punished, the forest guard may be reprimanded for oppression, and the Divisional Officer also for allowing it. Experience of this system has shown that there is generally a fair regeneration by stool shoots, but a lamentable absence of seedlings If the mature crops were always complete and vigorous this would not much matter, but in fact, the crops are usually not complete, in some cases very incomplete, and consist to a certain extent of stools that are now, or will soon become, unable to throw up shoots worth the ground they occupy. There is not a single seedling on the ground before the felling, nor in most cases after. The soil, even if protection is allowed to be made real, will take a year or two to recover its permeability. By that time it may be covered with a dense mass of climbers and coarse grasses, which may as likely as not be set ablaze Who then will venture to say that the period of closure allowed is sufficient to secure the regeneration (much less improvement) of the forests entrusted to us, if we are not to expect any advance growth. Though many of these coupes no doubt look well enough at present, for a coppice generally does look vigorous so long as it is less than ten years old, the real question is, what will a considerable proportion of these coupes look like by the time they are 25 to 30 years old.

Returning to our subject, M. Guinier seeks to establish two propositions with reference to regeneration in high mountain conifer forests. The first of these is not as completely intelligible as it might be ; *viz.*, "1st.—Contrary to appear-'ances sometimes, natural regeneration is not impossible 'anywhere, but is brought about after very variable periods and 'by very different means.

The second proposition is intelligible enough, and referring, as it does, to silver fir and spruce, is a somewhat radical variation on the classic ideas ; *viz.*; "2nd.—Generally seed is produced, and the 'young plants begin to prosper, only from the time when the 'forest has become *very open*, and the soil covered with a crop of 'small broad-leaved species, shrubs or small trees"

It is claimed that these conditions refer also to forests of other species, such as oak Such may be the case, and undoubtedly is so, in some cases It follows that full advantage can only be taken of the fact by a proper system of cleanings closely watched and carefully timed and executed Whether M Guinier is right or wrong with regard to the French forests of which he speaks, is a question which does not for the moment affect us much, as the Uniform Method is not yet adopted in India What we have to do is to find out the cultural needs of our own species in our own districts and on this point the letter of A W Lushing on in our May number is a step in the right direction Nevertheless it is necessary to note that there is in France a feeling that the "close seed felling' imported by M M Lorentz and Parade from Germany, does not always give the results that were expected It will be remembered that this classic felling consists in leaving standing just so many trees that their branches may touch when agitated by a breeze, and in thoroughly cleaning the ground of all brushwood the trees reserved being those with the highest cover The result has been a reaction against the whole method, and a tendency to revert to ancient French systems A curious tendency, collateral but not necessarily connected with the above, is the introduction of so-called "concentrated jardinage' under which the trees are left in a state of almost complete isolation ' in order that they may grow faster' It appears that French forest opinion is at present undergoing a phase of disorder and derangement some of the old established ideas being discredited without as yet anything very satisfactory to take their place We, being neither in France nor Germany, have to work out our own salvation Their efforts will interest and benefit us, but will not dispense us from putting our own shoulders to our own wheel

VI — *Vegetation of adult trees*

All forest trees says M Guinier, are of robust temperament as soon as the young plant has reached a certain age, which may be a few weeks or may be a few years In the climate to which they belong, they cannot only endure the sun, but indeed have a pressing need of it, and can equally well endure the other concomitant climatic conditions But different species have very different needs in the matter of light, and behave differently, according as they get it vertically or laterally

Light demanding species (such as pines) are those which only attain their normal shape and finest development when more or less isolated Nevertheless these species if they are to furnish long straight timber free from knots, have to be kept in close canopy for a great part of their growth being thinned out, when they have attained the necessary height, to such an extent that the lateral branches have free room to develop. Such species afford insufficient protection to the soil, which should be kept covered by means of an undergrowth possessing dense cover

Close canopy species (such as fir, spruce, and deodar) are those whose young plant is more or less delicate but which are capable of forming fine trees in a state of isolation, and can also form fine trees in close canopy, provided they are not dominated. It is this class of tree which furnishes long cylindrical logs free from knots, having that straight fine grain and narrow uniform increment which in the conifers distinguish good timber from bad In close canopy these species moreover form an annual shoot as long as or longer than they would do in the open, provided only that moderate thinnings prevent their becoming overcrowded. Spruce and deodar are remarkable for the magnificent crowns they develop when isolated, but as forestry is not a decorative art, it follows that these are the very trees which have most need of the crowded state in order to avoid the otherwise inevitable and ruinous large knots Fortunately they can endure this crowded state as well as any

Shade demanding species are few and not very important (It will be observed that M Gurnier makes three, instead of our usual two classes with respect to light requirements) Yew, box, holly, and a number of evergreen shrubs are such as will pass the whole normal length of their life in comfort under a fairly dense cover But even these species (especially the yew) will sometimes attain exceptional demensions if they are more or less isolated It is not strictly correct to class the ' close-canopy species" as "shade-demanding species,' in view of the important distinction that in later life the one class will endure being dominated, while the other will not The question is not one of infancy, but of mature life

In "seeking the light," trees have different habits The broad leaved species will undergo remarkable contortions in order to get the leader or a side branch into some opening inconveniently situated Resinous species for the most part, disdain such undignified demeanour They will do their best to pierce the cover overhead, but if they fail, the leader ceases growing, and the tree dies (unless of course it belongs to a species that can persist indefinitely under cover) When a crooked tree is found, it is generally the result of mechanical entanglement among the branches it sought to pierce

An important and interesting subject of study is the sequence of events following the destruction of a forest In many cases, at high altitudes or in populous districts, the forest once destroyed is destroyed for ever But fortunately,, in other cases the forest does but suffer a temporary eclipse. In Sind, forests are washed bodily away But soon a "Kacha" or alluvial flat is formed. This becomes covered with a dense growth of Tamarix. Among the tamarisk appear young plants of babul or Populus, and also of "kandi" or Prosopis The tamarisk attains its maturity and disappears, leaving a fine babul forest in its place This may remain indefinitely a babul forest but it sometimes happens that the river recedes leaving the quandam babul forest high and dry above the reach of floods when the forest becomes one of kandi and eventually, if things come to the worst a desert with a few scattered bushes of kandi and caper In the Himalaya the people burn a bit of splendid fir forest and cultivate the land for a few crops Thrown out of cultivation, it becomes covered with Indigofera, Spiræa, &c This gives place to a quite European looking broad-leaved forest of birch horsechestnut, hornbeam, hazel Pyrus &c &c, containing many fine trees among which the seedlings of spruce and fir establish themselves and so bring things back to the starting point

In the Punjab and elsewhere, a forest may be destroyed by fire or otherwise or excessive fellings made, with the result that the area becomes a hopeless and dangerous sea of grass 20 feet high The life of this may or may not be perpetuated by continually burning on the part of those interested in grazing but there comes a time when the clumps begin to die out and when young plants of good species establish themselves or are inserted with every expectation of success These and such like problems with those connected with light, when how how much offer a vast field for enquiry Patient persevering observation of facts cautious deduction of reasons are the only safe guides

F G.

II.—CORRESPONDENCE

Flowers of Populus ciliata

My attention has been drawn by a friend to the absence from the Kew and other Herbaria of any specimens of the *male* catkins of the common Himalayan poplar (*Populus ciliata*) Though I have had plenty of opportunity both in the Eastern and Western parts of the great range, I have never seen the male catkins, the female are of course exceedingly plentiful and conspicuous In the Forest Flora' Brandis omits any reference to the male flowers and Griffith in his Notula says he has never seen them If forest officers in the hills would kindly keep an eye on the poplar next spring and if possible, collect and dry a good supply of the male flowers they would do a good service for the specimens would be greatly appreciated at Kew and elsewhere They can be sent to me at the Forest School, Dehra Dún

J S. GAMBLE.

The occurrence of Lac in the Hills.

I should feel much obliged if some of your readers interested in the matter, could give me information through the columns of your Journal regarding the distribution of the lac insect (*Coccus lacca*) in the hills Has Lac ever been found in the hills, and if so at what elevation and on what trees ?

A. E WILD.

16*th July*, 1897

IV.—REVIEWS

Forest Administration in Burma 1895-96.

Sanction was received during the year to the increase of the staff of the Imperial and Provincial Forest Services in Burma by 22 appointments and to the re-organization of the subordinate Forest Service The latter scheme was drafted several years ago before the requirements of Upper Burma had been fully ascertained Since then also, work has developed to a greater extent than was anticipated and it will still be necessary to entertain a temporary establishment costing over Rs 30,000 annually, which in all probability will have to be increased before long

The following alterations were made during the year in the area of several Forests

	Area in Square Miles.	
	On 1st July, 189˙.	On 30th June, 1896.
Lower Burma	7 072	8,397
Upper Burma	4,408	5,438
Total	11,480	13,835

Proposals for the reservation of a further area of 3,476 square miles (2,128 square miles in Upper Burma and 1,348 square miles in Lower Burma) were under consideration at the close of the year The reserved area includes 573 square miles in Lower Burma and 136 square miles in Upper Burma which are subject to taungya cutting privileges Rights of this nature were during the year extinguished over 125 square miles of reserved forest in Upper Burma, partly in exchange for advances to buy plough cattle, and partly by the lapse of concessions granted for a limited period only.

The area of unclassed forests is estimated at 28,327 square miles in Upper Burma and 17 665 square miles in Lower Burma, exclusive of Arakan so there is still considerable room for the extension of reserves

In 1890 a number of village forests were created in the Thayetmyo district, with a view to the protection of cutch by the villagers interested who were given special privileges in the forests The measure has not however, proved a success and a conference which was assembled for the purpose of enquiring into the question reported that no difference existed between these forests and the unreserved tracts The village forests have consequently been disafforested and other measures are to be taken for the preservation of cutch

In Lower Burma 135 miles of reserve boundaries were demarcated at a cost of Rs 1 276 and Rs 4 084 were spent on repairs In Upper Burma 616 miles were demarcated at a cost of Rs 6,348, while repairs cost Rs 1 274

Surveys of reserved forests on the 4 inch scale were carried on in both sections of the province by parties of the Survey of India and the Forest Survey Branch 357 miles being computed in Lower Burma and 174 miles in Upper Burma 115 square miles of undressed forests were also surveyed on the 2 inch scale. Considering the importance of the work and the enormous area still remaining to be done it seems very desirable that the staff of the Forest Survey in Upper Burma should be considerably augmented

At the close of the year Working Plans had been completed or were in progress for 1 526 square miles in Lower Burma leaving 5,803 square miles still to be taken in hand no Working Plans had been sanctioned in Upper Burma but a plan had been completed for 37 square miles and arrangements made for starting work in the Pyinmana Division where owing to the approaching termination of the leases, Working Plans are urgently needed

The record of forest offences shows a considerable increase over that of the previous year A large proportion of the cases both in Upper and Lower Burma originated in connection with the protection of the cutch tree In Upper Burma illicit cutch boiling was carried on under the cloak of claims to own waste land, and in Lower Burma where cutch is reserved, the tree was largely felled in clearing land for Taungyas The Lieutenant-Governor remarks on this point as follows —

The attempts of the Forest Department to preserve cutch "have necessarily caused considerable friction with the *taungya*-"cutters which is illustrated by the significant fact that during "the past year, of 34 cases of prosecution for injury to forest by "fire, no less than 23 occurred in Tharrawaddy, Prome, or "Thayetmyo As has been explained in reviews of previous "reports, the Burma Administration has been engaged for "some years in endeavouring to discover some *modus vivendi*

" by which the interests of forest conservancy and, indirectly, of
" the people themselves may be reconciled with the requirements
" of *taungya* cultivators. In 1894-95 it was thought that a solu-
" tion of the problem had been found in the demarcation of
" *taungya* areas. Subsequently difficulties arose in carrying out
" this scheme and the question had to be re-opened. It was then
" decided to convene a conference to consider the plans which had
" been suggested for the solution of the question and to make its
" own recommendations as to the policy to be adopted. The con-
" ference met in February 1896 and made recommendations which
" will, the Chief Commissioner hopes, form the basis of a lasting
" settlement. In accordance with these recommendations the
" scheme for the demarcation of areas for *taungya* cultivators has
" been abandoned as impracticable. It has been decided that
" small reserves varying in area from 500 to 3 000 acres and
' aggregating from 100 to 150 square miles shall be formed in the
" Prome and Thayetmyo districts, that these areas shall be strictly
" closed against *taungya* cutting, and that in other parts of the
" two districts no restriction should be placed on the felling of the
" cutch tree. The curtailment of area available for *taungya* cut-
" ting will necessarily inflict some hardship, but on the other
" hand relief will be afforded to villagers who have hitherto been
" harrassed by prosecutions which were unavoidable if the cutch
" tree was to be saved. In other words the *taungya*-cutter will
" have less land to cultivate but he will be able to cultivate it
" unmolested."

In the meantime the Upper Burma plan of permitting trees below a certain size to be felled in taungya clearings is to be adopted as a palliative measure.

There has been a difference of opinion among Civil Officers in regard to the expedience of compounding offences, but the Lieutenant-Governor believes that so long as superior officers discharge their duties properly in these matters, the advantages of the compounding system, namely, the saving of time and trouble to the villagers, outweighs its disadvantages, namely, the opportunities of extortion which it affords.

In Lower Burma the fire protection of 781 square miles was attempted and was successful over 711 square miles, the cost being Rs 54 per square mile attempted. In upper Burma 526 square miles were attempted, and 467 square miles actually protected at a cost of Rs 11 per mile attempted. The difference in cost is said to be due to the favourable situation of many of the protected areas in Upper Burma. The Conservator, Tenassarim circle, remarks that both officers and subordinates have much to learn in regard to fire protection and thinks the fire lines are not burnt broad or clean enough and that too much money is spent in sweeping lines. This may be so, and we trust he will be successful in introducing a better state of things, but the protection of forests in which the leaves keep on falling all through the hot weather is always much more difficult than that of the drier forests which shed their leaves early in the dry season.

The Inspector-General of Forests has recorded his views on the various opinions put forward regarding the effects of fires in influencing reproduction, in a letter to the Government of Burma which we re-produce below

" I have carefully read the opinions on the effect of fire-pro-
' tection to which your letter gives cover During my recent tour
' in Burma I have, moreover given special attention to the subject
' in question and have by renewed observation, confirmed the
' conclusions at which I had arrived during my previous resi-
' dence in Burma and in the course of several official visits to
' that country "

' 2 Evergreen, tidal and riparian forests may be left out of
' consideration, as they do not burn , and as regards the question
' under consideration, we have, therefore, only to deal with the
' deciduous forests In the majority of the opinions before me this
' class of forests has been treated as uniform in their composition
' and characteristics This, however is by no means the case , and
' in order to enable us to gauge correctly the extent of the effects of
' fires on these forests, it seems to me essential that the main class,
' deciduous forests, should be further sub-divided in accordance with
' their composition I intentionally use the words " extent of the
' effects," for, in all forests through which a fire passes, the same
' effect must be produced either in a greater or less degree And
' as the composition of a forest varies, so must the effects of fire
' therein be more or less pronounced '

' 3 Forests of pure Engdain may for the present be left out
' of discussion and I propose to deal only with such forests as con-
' tain teak, cutch pyinkado, or any other species of commercial
' value '

The sub-classes which I propose to adopt for my purpose are—

(*a*) Forests in which the valuable species are found with an undergrowth of evergreen dense, periodically and gregariously flowering bamboos, which more or less prevent the natural reproduction of tree-growth at any other time except whilst the bamboo is seeding.

(*b*) Forests in which the undergrowth consists of bamboos with a lighter foliage and which flower sporadically in stems or clumps as well as gregariously, and in which tree reproduction can always take place, but more especially when the cover has been opened out by the general, but also by the sporadic, flowering of the bamboo

(*c*) Forests in which the more valuable trees are found in a mixed or pure forest (which latter is apart from small areas, almost entirely confined to cutch), and with an undergrowth of shrubs and herbaceous plants and grasses only.

The observations generally recorded that little or no ‘humus, in the sense usually adopted, is found in any of the ‘sub-classes of the deciduous forests in Burma even when fire-‘protected for some years, must be accepted as correct’

‘However there can be no doubt that in fire-protected forests ‘the leaves and other decaying vegetable substances are returned ‘to the earth and that the chemical properties of humus are im‘parted to the surface-soil which is moreover loosened by the ‘action of of myriads of earthworms ants beetles etc’

It seems to me immaterial whether the manuring principles ‘are brought back to the soil by direct decomposition or in a ‘more indirect manner through the fæces and decomposing bodies of worms and insects like stable manure ploughed under in fields’

‘In the case of fires the wind dissipates the ashes and the rain ‘washes them away especially on hilly ground Very little of what ‘has been extracted from the soil by vegetation is returned to it’

5 In forests of sub-class (*a*) protection from fire, can have ‘no direct influence on the actual reproduction of trees, except ‘during and for some years after the flowering of the bamboos ‘A fire when the culms begin to dry, and before the bamboo seed ‘has germinated might perhaps even be beneficial in this respect, ‘but at an incalculable cost to the growing stock Moreover it is ‘not at all certain how much a fire which would of necessity ‘be fierce might affect the seeding power of mature trees during ‘the critical period when reproduction can take place

Apart, however from this to my mind unsolved problem, ‘the fact remains that constantly recurring fires must injuriously ‘affect the producing power of the soil It is true that the fine ‘pure fertile loam produced by animal life out of decaying ‘vegetable substances is also liable to be washed away by rain, but as ‘pointed out by Mr Oliver, a covering of dead leaves remains long ‘enough on the ground to prevent this This is especially notice‘able in forests of sub-class (*a*), where dead bamboo leaves cover ‘the action of worms till the very end of the rains The fact that ‘the nutritive agencies are absorbed by the soil instead of being ‘stored on the surface in the form of a more or less inflammable ‘material, renders an occasional fire less hurtful to the growing ‘stock, as well as to the soil, than it would be in cases where such ‘a layer of humus is present , and, in consideration of this fact, ‘the use of properly controlled fires in selected areas is indicated ‘when the bamboos flower in forests of this sub-class In view, ‘however, of the uncertainty as to whether the seeding power of ‘the trees on the ground may not be temporarily affected by such ‘fire, it would seem only provident to be prepared with an ‘adequate supply of seed collected elsewhere.’

‘Fire-protection in Burma has not been established sufficiently ‘long to give data regarding the increase in the rate of growth of ‘teak and other valuable trees in fire-protected areas as compared 'with those in areas exposed to fires; but as the general aspect of 'the vegetation in such areas as have been fire-protected for some 'time has become much more luxuriant, there is every reason to 'believe that the growth of such trees has benefited in the same 'manner The increased luxuriance of growth, generally, is specially observable in deciduous forests of this sub-class'

6 'Forest fires in forests of sub-class (*b*) are harmful 'throughout their existence Trees of all age-classes are scattered 'over the ground, and the younger ones are more seriously affected 'by being scorched or cut back than those which have outgrown 'this danger That in spite of this we find the teak better repre'sented in forests of this sub-class which have burned over year 'after year than any other species, merely indicates, in my opinion, 'that the former is more capable of withstanding and to a certain 'extent of outgrowing, the effects of fire than any other tree

'I am aware that the proportion of teak seedlings in burned 'forests of this sub-class is, owing to its superior power of resis'tance, greater than in protected forests, and I do not wish to 'contradict the statements made, 'more freely in the "Indian 'Forester' than in the official correspondence it is true, but still 'on record, that the actual number of teak seedlings in unprotected 'forests is greater than in fire protected areas'

"Indian Forester of May July, and August 1896

'There are reasons for this The ground may be clearer and 'the cover over head less dense, and especially where the plants 'cut back and which have sent out new shoots, are allowed to 'count as seedlings, the statement may be correct "F B D," in 'the "Indian Forester' of July last, accepts it as such, but per'tinently adds "we do not want annual fires for germination" I 'fully agree in this, for it is unquestionable that each successive fire 'destroys the problematical advantages established by its fore'runner Granted that the teak trees in areas overrun by fires seed 'more freely (a crop of despair), that the number of teak seedlings 'in such forests is larger, I know that those grown in a fire-pro'tected area are healthier grow faster, and will yield better timber 'A tree inside a fire-trace may have a more severe struggle to get 'its crown above the undergrowth, but to make fire do the work 'of improvement fellings is too absurd to be seriously considered'

'Taking everything into consideration, the effect of fires in 'forests of sub-class (*b*) on reproduction, not merely germination, 'but including the earlier stages of the teak tree's life, is in my 'opinion most pernicious I feel convinced that a serious study of 'the problem at any place where a fire-trace runs through a teak'producing area of sub-class (*b*) will, if the observations extend to 'seedlings and to young growth up to 20 feet in height, prove my 'assertion to be correct'

'That constant fires retard the growth of established trees, affect their health, injure the timber, and even kill numerous 'trees, has been accepted even by those whose battle-cry has been '"too much fire-protection."'

‘ The injurious effect on the soil in forests of sub-class (*b*) is
‘ even more pronounced than in sub-class (*a*) The rain acts more
‘ directly on the soil, and the numerous stone-covered pinnacles in
‘ unprotected forests show the extent to which the soil is washed
‘ away

‘ In fire protected forests of sub-class (*b*) the insect world and
‘ worms work below a cover of leaves which protects the assimila-
‘ tion of the nutritive substances with the soil if not throughout
‘ the year still till a living cover of grasses and herbs has
‘ established itself ’

7 ‘ Forests of sub class (*c*) are as regards teak, of much
‘ smaller extent and chiefly confined to Upper Burma, but as
cutch producing areas they are of great importance

The teak in these forests is chiefly produced in family groups,
the formation of which can be encouraged and accomplished
‘ without the use of fires In forests of this sub class fires have no
‘ *raison d'être* whatsoever The extent to which cutch reproduc-
‘ tion takes place in suitable localities, by no other means than fire-
‘ protection forming thickets in but few years, has frequently
been observed and no further arguments are needed to show the
‘ advisability of such measures as regards forests of this character ’

‘ The effects on the soil in forests of this sub-class by
‘ recurring fires varies considerably in accordance with the more
‘ or less dense cover of grass and herbaceous plants

8 Pyinkado and other more valuable trees are all more
‘ sensitive than teak to the effects of fire and protection conse-
‘ quently affects them even more than it does the teak ’

‘ I entirely agree with Mr Carr that the damage done to
‘ young tree-growth resulting from fire cannot be prevented by
‘ any other means than fire-protection while impediments to repro-
duction and future growth which may be due to fire protection
‘ can be prevented by other means , and I therefore strongly
‘ advise the policy of extending fire-protection as far as
funds and administrative considerations allow ’

9 ‘ In one of the criticisms before me it is asserted that insects
‘ are much more numerous in fire-protected forests than in others
‘ This probably is the case but I doubt whether this does not refer
‘ to useful or at least harmless insects only , for previous experi-
‘ ence certainly tends to indicate that burned and injured forests are
‘ more liable to attack by obnoxious beetles or larvæ The officer
‘ who made the statement in question might perhaps be be asked
‘ to amplify it ”

Para 5 of the above touches on an unsolved problem which will have to be faced before long, namely the treatment to be adopted when next the Kyathaungwa bamboo (*Bambusa polymorpha*) flowers The bamboo, as is well known, falls to the ground after flowering, and if the culms are not burnt when they become dry enough, the forest remains for some years absolutely impenetrable, and planting operations on such areas are out of the question. On the other hand if fire is resorted to, the destruction of young saplings and the damage to the larger trees is enormous. Divisional Officers will therefore have to decide whether they should protect the growing stock and forego the opportunity of extensive cultural operations, or sacrifice the former in favour of the latter. In unprotected forests there will of course be no choice but in fire-protected areas the question will be a very difficult one, and areas to which fire can be applied without much damage should, if possible, be selected and marked off in advance.

No additions of any importance were made to the area of regular plantations but taungya plantations were increased in Lower Burma from 36 294 acres to 38 148 acres, and in Upper Burma from 443 to 687 acres.

The Conservator Tenasserim, criticizes the teak plantations of his circle which he considers are a failure. He says —

"I have carefully examined a large number of teak *taungyas* 'in the West Salween Thaungyin and Toungoo divisions, and 'was greatly struck by the unsatisfactory condition of many of the 'older plantations.'

'From experience gained in Berar, Coorg and Burma I am 'of opinion that pure teak plantations are not a success.'

'It is true that in the earlier stages a well managed *taungya* 'presents a most satisfactory appearance the area being covered 'with rows of healthy looking plants but I have frequently 'noticed that when about 8 years old their upward growth is 'arrested they commence to seed, and cease to appear healthy and 'vigorous.

'This condition is due, I believe to drastic weedings, which 'remove all the undergrowth a process still further assisted by the 'canopy natural to young teak, which is so dense that it is difficult 'for any undergrowth to exist under it.

'On the other hand if the plantation has not been successful, 'and the weedings have been insufficient then as may be seen in 'West Salween many of the *yas* are covered with a dense growth 'of bamboo, which has entirely suppressed and exterminated the 'teak.'

'In pure teak plantations owing to the entire absence of leaf-'shade during the hot months, the soil is freely exposed to the sun 'and as all undergrowth is systematically removed the root system 'suffers, again, during the monsoon the heavy rains beating on 'the bare and exposed ground causes much wash and consequent 'deterioration of the soil.

'The result of these pure patches is that many of the saplings 'become hide bound are attacked by insects or fungi or owing to 'the absence of leaf mould become stunted and unhealthy, and they 'undoubtedly suffer from not having surrounding trees to draw 'them up, as is the case in the natural forest.'

'I am further of opinion that sufficient attention has hitherto 'not been paid to the all-important work of thinning out the more 'advanced plantations.'

'It is imperative that periodical thinnings should be arranged 'for and carried out under European supervision. Even if there 'is no demand for poles, it is necessary that room should be made 'for the most promising saplings, and all diseased or worthless 'stuff should be removed.'

'Probably the paucity of officers has prevented this important 'work from being taken in hand, but matters are different now, 'and in many plantations operations should be at once commenced.'

'I believe that numerous Forest Officers in Burma are, like 'myself, prejudiced against pure teak plantations, and I would urge 'that the subject be thoroughly investigated, and, if necessary, a 'more suitable system introduced.'

Personally I would advocate improvement fellings such as are in force in the Melghat (Berar), such regulated fellings being more suitable to the forests of this circle (except evergreen) than 'the present system of annually forming small plantations of pure 'teak, the remainder and greater portion of the forest being 'untouched."

We certainly cannot endorse this sweeping condemnation of teak plantations especially taungya plantations. Teak grows naturally pure on alluvial soil and plantations in such localities have succeeded admirably. Teak is also found growing naturally pure on the hills in groups of greater or less extent. The original idea however of the teak taungya system, was not to create plantations of pure teak but to increase the stock of that species in forests in which it is deficient, or on areas in which owing to repeated *ya* cutting the original stock of teak has been reduced to worthless coppice shoots. It was thought that the carelessness of the cultivator and the tendency of bamboos and certain species of trees to crowd out teak would be sufficient to ensure the new crop developing into a mixed forest with teak scattered in groups or singly and as a rule this result has been fully attained. In some cases no doubt plantations on indifferent soil have been too successful but the remedy is easy and obvious; in other cases the plantations have been an entire failure, but such failures have cost little or nothing and leave us in a no worse position than when we started.

It is however likely that the area annually planted under the taungya system will be very much restricted in future. In Upper Burma reproduction is as a rule so good that plantations will not be required, and in Lower Burma the areas suitable for such operations must by this time be approaching exhaustion.

Cultural operations, and improvement fellings to favour teak were only carried out to any great extent in the Pegu circle. Some 375 acres of flowered bamboo area were sown with teak in the Tharrawaddy Division at a cost of Rs. 4,307, and creepers and dominating overgrowth were cleared away from young teak trees over some 30 000 acres, principally in Prome and Tharrawaddy at a cost Rs 18 317

Teak trees for future extraction were girdled as follows —

Tenasserim Circle, Reserved Forests	5 900	Trees
Pegu ,, ,	15 453	,,
Eastern ,, , ,,	1 650	,,
Lower Burma unreserved Forests	4 362	,,
Total	27 365	Trees

The quantities of teak and other timber extracted from the forests during the year were as follows —

Lower Burma

	Teak	Other kinds	Total
	C Ft	C Ft	C Ft
By Government agency	2 318 572	61 429	2 380 000
By purchasers and under trade permits	1 015 061	13 376 784	14 391 845
Under free permits	8 432	139 531	147 963
By lease holders of forests	7 494	80 202	87 696
Total 1895 96	3 399 559	13 607 946	17 007 505
Total for 1894 95	2 689 000	13 388 693	16 077 693
Increase or decrease in 1895 96	+ 710 559	+ 219 253	+ 929,812

Upper Burma

	Teak	Other kinds	Total
	C Ft	C Ft	C Ft
By Government agency	359 726	14 417	374 143
By purchasers and under trade permits	9 007 978	6 464 882	15 472 860
Under free permits	269 276	22 612	291 888
By lease holders of forests		618 559	618 559
Total 1895 96	9 636 980	7 120 470	16 757,450
Total for 1894 95	9 549 059	6,091 047	15,640 106
Increase or decrease in 1895 97	+ 87 921	+ 1 029 423	+ 1 117 344

There was an increase of 50 per cent in the revenue from cutch in the Western Circle In the Yaw Division licenses were sold at reduced rates on the condition that the wood should be reduced to shavings by means of a spoke shave, instead of chips The experiment proved a perfect success, as, the licensee only cut 15 trees and turned out 1 500 viss of cutch, whereas the same man working under another license on the chipping system only obtained 1,800 viss from 40 trees

The trade in Rubber has continued to decline. An attempt has been made to prevent the destruction of trees in forests beyond administrative control by imposing a prohibitive duty on underground root rubber, which it is said can be readily distinguished from rubber from other parts of the tree

The financial results of the year were as follows

	Receipts Rs	Expenditure Rs	Surplus Rs
Upper Burma	22 77 389	5 65 327	17 12 062
Lower Burma	33 12 987	13 47 811	19 65,176
Total	55 90 376	19 13 138	36,77,238

VI -EXTRACTS NOTES AND QUERIES

Forestry in the Ardennes.

By W R FISHER

Owing to the great demand of the Belgian coal-mines for wood the owners of forests in the Ardennes can sell all their forest produce at remunerative rates and as a very large area of this region, at elevations of between 800 and 2 000 feet above sea-level, and with a stiffish loamy soil resulting from the disintegration of quartzites and slatey rocks is unsuited for permanent agricultural cultivation, much attention has during the last half century, been paid to the improvement of the forest growth, for which the moist climate, with an annual rainfall averaging 35 inches, is most suitable

Standing, as I did yesterday, on an elevated hillside, I could see before me the dark green patches of Scotch pine and spruce woods , the white bark of the birch standards, on extensive tracts of Communal land , the brown rounded contours of the beech and oak woods , the bare patches of brown heather or evergreen broom, and the pastures and fields they overlooked The coniferous forest has been introduced during the last half century ; the beech and oak woods are the relics of the vast forest which, in the days of Julius Cæsar extended from the Rhine to some distance beyond the river Meuse The birch forest is the result of a system of cultivation termed *sartage*, in which the common land of a village is every twenty years cleared of all forest growth except a number of birch standards, the produce being sold or utilized by the peasants, who burn the smaller branches, heather, broom, &c., on the ground; they then divide the area into portions amongst themselves, on each of which a crop of rye is grown, and the area is then abandoned to nature, the birch reproducing itself by stool shoots or seed. Any birch standards which are large enough to be used profitably for pit timber are felled with the rest of the crop.

The Belgian Province of Luxembourg contains 1,030,000 acres, about one-third of which area is wooded, and in 1847 126,000 acres were waste land covered with heather and broom. In order to remedy this state of things and to improve the then existing woodlands, the Government undertook to supply seed gratis, and provided five nurseries for forest plants. The utilization of the waste land was, however, so well taken up by the landowners, that by the end of 1887 only 42,000 acres of waste remained in the province, the balance having been converted into 49,000 acres of arable land pastures and 35,000 acres of woods.

Private enterprise having thus been properly directed, Government was able to relax its efforts, and by 1882 all the nurseries were sold to private people and free distribution of seed and plants was stopped.

The area in 1889 of forests in Luxembourg is given in the following table:—

PROPRIETOR	High Forest		Coppice with Standard	Simple Coppice	Land freshly sown or planted	TOTALS.
	Beech and Oak	Conifers, chiefly Scotch Pine				
	Acres	Acres	Acres	Acres	Acres.	Acres.
State	3,487		24,425			27,912
Communes	25,683	7,170	99,234	47,848	3,426	183,361
Hospitals	10		15	274		299
Private Owners	35,954	37,077	45,746	42,669	12,050	173,496
Totals	65,134	44,247	169,420	90,791	15,476	385,068

The average annual production of an acre of forest, as calculated by a Special Government Commission appointed in 1883, is as follows, for the different classes of forest:—

High Forest	Beech and Oak	... 70	cubic feet.
	Coniferous	... 70	" "
Coppice with Standards		... 56	" "
Simple Coppice	...	... 35	" "

Probably the production of coniferous forests was understated and may be placed at 100 cubic feet.

The price of standing wood by the cubic foot varies as follows, according to size and quality —

Oak	.. 9d	to	3s.
Beech	... 4½d,	„	10d.
Coniferous	3d	„	4d

(Coniferous wood hitherto only used for pit props and wood pulp)

The production of pit timber is very profitable, and woods of Scotch pine, spruce or larch about thirty-five years old, are worth £40 to £60 per acre In this case the soil being worth from £4 to £10 per acre and the cost of sowing or planting per acre being from 25s to 40s the initial capital is from 105s to 240s., which, placed at 6 per cent compound interest for thirty-five years, will amount to £29 and £66, so that it is clear that this crop yields about 5 per cent The above figures do not include charges for supervision and land tax which are, however, covered by the receipts from thinnings as even thinnings in a Scotch pine wood twenty years old are saleable at about £4 net per acre.

Oak wood finds the same employment as in Britain, and large beech trees are sawn into planks, which are afterwards used for making gun stocks furniture, and other purposes, whilst the smaller beech trees are made into sabots (wooden shoes), the manufacture of which forms a great local village industry Although coal is plentiful there is a fair sale for fire-wood The average produce from the forests of Luxembourg is placed at 56 cubic feet per acre, worth including fire-wood 2½d a cubic foot, and producing a total net revenue of £190,882

Beside the sales of wood a small revenue is obtained by leases of shooting, pasturage, sale of grass, broom, and by temporary cultivation in the forests producing altogether about £15,000, or 9d an acre The rates for shooting-leases, especially in forests where there are red deer, are increasing and may amount to 1s 6d an acre, and even more The forests are not fenced and red deer roam from forest to forest , except for their preference for larch, of which they ruin the young plantations, they do not appear to be very hurtful to the woods . hares are becoming numerous and do more damage, but fortunately rabbits are rare.

The method under which high forests, except coniferous woods, are generally managed, is to go over the area every twenty years and thin them, trusting almost entirely to nature to re-stock the area As a result of this system of periodic thinnings, many of the forests have become insufficiently stocked, bilberry and heather forming the soil covering, a sure sign of deterioration of the soil. The coniferous forests are generally clear cut at an age between 33 and 40 years, as soon as they are large enough to serve profitably as pit-timber. The area after felling is generally sown up for a year with rye and then re-stocked with conifers, generally by sowing the Scotch pine or planting the spruce.

As an example of a well managed private forest in this region, situated at a distance of about 60 miles from the Belgian coal-field I propose describing what is being done in the forest of Mirwart, belonging to two brothers named von der Becke and to Dr. Schlich the well-known author of the Manual of Forestry, who himself manages these woods. Their total area is 3,000 acres, and they are situated on undulating land on both sides of the little river La Lomme the picturesque old historic chateau de Mirwart being about 6 miles from the town of St. Hubert. The best part of these woods is on a northern aspect facing the chateau and consists chiefly of beech up to 130 feet in height, with some fine oak and sycamore. This wood contains 3,000 to 4,000 cubic feet per acre; in it an oak attains a diameter of 2 feet in about 100-120 years, and beech and sycamore the same diameter in 80 to 90 years.

In other parts of the forest of Mirwart oak standards over coppice prevail with beech trees sometimes isolated and sometimes in little clusters. here almost everywhere the coppice stools appear to be too old to give healthy shoots and the latter are over-shaded by the beech standards so that any further treatment as coppice with standards is unadvisable. A change of system is also called for, because the price of coppice is constantly falling and oak bark hardly pays for stripping whilst beech standards are very branchy and yield much less timber than beech in high forest.

Besides the above woods, there is an area of 75 acres under simple coppice of oak with some ash hornbeam and alder and 125 acres under Scotch pine poles of different ages, up to 40 years. Larch has been planted 200 000 plants having been placed in the blanks about 40 to 50 years ago but these plants have been nearly all destroyed by red deer. Larch disease is also common, though some of the trees 40 years old are very fine and healthy. Owing to these misfortunes larch will in future be planted only experimentally on areas with a northerly aspect. It is interesting to note that some natural reproduction of larch has appeared under the older larch trees.

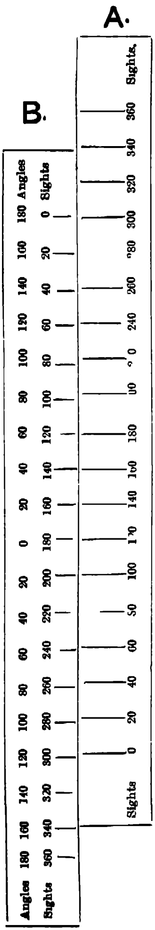
The beech woods and the irregular coppice with standards were managed up to 1892, when the present owners acquired the Mirwart estate under the system of periodic thinnings already described and which gave as bad results as might have been expected. High forests can only pay when the ground is kept fully stocked and sheltered by a dense crop of trees, and the soil soon deteriorates when the cover is interrupted by excessive thinnings. The areas under coppice with standards were also suffering from the bad reproduction of the old stools and the injudicious distribution of the reserved trees. The chief problem, therefore, for Dr. Schlich, when he undertook the management of these woods, was to substitute a high forest treatment everywhere in the old coppices and to dispose of the badly grown isolated beech and oak standards in the course of 8-10 years, whilst preserving intact for future working the fine beech woods in front of the Chateau

With this object in view, 1 000 acres are being cleared of all defective and over mature trees and of the underwood, only promising oak standards and groups of beech poles or saplings being left intact, the area is then planted with three years old spruce plants at distances of 3½ to 4 feet apart, the whole work, including the cost of the plants, 6s per 1,000, costing 25s per acre The timber which is being removed is sold standing at about £25 per acre, whilst the value of the future crop, when forty years old, including the standards which have been left, is estimated at £80 per acre All the standards have been carefully pruned of dead branches and of low growing living ones less than three inches in diameter, the cost of this operation being covered by the sale of the branches pruned off In selling the timber it is usually divided into small lots of standing trees, which have been previously marked and are sold by public auction the underwood being sold separately by area in small lots

The young spruce plantations have succeeded admirably, the rate of growth of the coppice shoots having been too slow to interfere with their growth many of those planted in 1894 are already 4 feet high and with shoots of 1½ feet last year In some of the drier parts Weymouth pine has been planted instead of spruce, and some three years old oak plants have also been planted on a small area and several thousand ash plants on a locality specially suited for this species The spruce is planted in pits about 9 inches cube the pits being dug by men at 1s 8d a day whilst the planting is done by women at 1s per diem

As soon as the 1 000 acres of inferior forest have been dealt with, *i e*, after 1902, the fine beech wood referred to above will be treated and regenerated naturally There are some parts in this wood where patches of small beech seedlings have already developed, and the older trees surrounding these patches will first be removed and fine oak saplings five feet high planted in them, in order to get a large mixture of oak with beech It is estimated that the regeneration of the fine beech wood will not be concluded until 1930, when the areas planted with spruce will be ready to yield heavy spruce thinnings and also a supply of timber from the broad-leaved standards and thus the continuity of yield in the forest will be maintained

Before terminating this paper I should like to refer to the piscicultural enterprize of Mr von der Becke He has prepared fifteen tanks with a total area of twenty acres, and stocked twelve of them with 40,000 small trout of the following species —Californian rainbow trout (*Salmo irideus*), American brook trout (*S fontinalis*), Swiss lake trout (*Truta lacustris*) American black bass, the small mouthed variety (*Micropterus dolomeus*), as well as the indigenous trout It is surprising to see how rapidly these trout increase in size, and I have just seen a basketful, caught with the fly, of 16 trout, weighing 8lbs, which were put into the tank in April, 1894, when they were six weeks old.



Slide Rule for Angles

To give the Angle Comprised between two Compass Readings

In plotting a compass survey, it is sometimes desired to use the angle contained between two bearings, rather than to lay off each from the North point. A slide rule can easily be made out of two strips of wood, card or paper, which will save all the trouble of additions and substractions of angles. The strips may be of any length sufficient to show the half degree, say 360° × ·05 = 18 inches. These strips are then ruled to scale showing degrees and half degrees, the quarter being obtained by estimation. The rule A is simply divided as above. The rule B is similarly divided, but bears two rows of figures. Above the figures indicating degrees is another row showing the complementary angle. That is to say, if X is the difference between the two compass readings the angle required will be X—180° or 180°—X, according as X is itself greater or less than 180°.

Now suppose the two compass readings are 300° and 240°. Required, the angle between them. The 0 of the scale A is brought opposite to 300° on the scale B. Opposite to 240° on A is found 60° on B. Above the 60° on B is found 120, which is the angle required. The illustration does not show the full graduation of the scales, being two small, but the principle is clear.

Paul Vessiot.

(*In Révue dés Eaux et Forêts*)

Plant Pathology.

Diseases of plants induced by Cryptogamic Parasites, By Dr. Karl Freiherr von Tubeuf English Edition, by William G Smith B Sc, Ph D Pp xv × 598 (London : Longmans, 1897)

When the German edition of this work appeared, early in 1894, it at once took rank as one of the most comprehensive and accurate treatises on the subject that had as yet appeared, and the English edition we now have to welcome still deserves this tribute to its merits for the author has taken the opportunity of adding considerably to the already bulky volume

The fungus-diseases of plants now number so many forms, that no apology is necessary for treating them separately from the very numerous other diseases of plants but it should be clearly borne in mind that only part of the very wide subject of the pathology of plants comes under this head, as may be readily seen on comparing the new edition of Frank's Krankheiten der Pflanzen" which has appeared in the interval and of which the first volume is devoted to the diseases due to non-living agents the second to those caused by parasitic plants (not fungi only,) and the third to pathological states induced by animals

Thus comprehensive works on the whole range of this vast subject are not wanting and the student should observe that the standpoint from which a treatise like this is written differs considerably from those assumed by writers on the general subject of pathology, or those who deal with the morphology and physiology of the fungi

Berkeley Frank Sorauer, and Hartig have shown that the diseases of plants constitute a theme by itself which may be treated with reference either to the symptoms and progress of the pathological conditions where the victim of disease furnishes the principal phenomena discussed or to the causes or agents which induce these pathological conditions These agents may be internal or external and the latter comprise factors of the non living environment or living organisms —animals or plants in anti-biotic relations to the host, or victim

The present large volume of more than 600 pages with 330 illustrations, is devoted as said to the narrower theme and bears witness to the astonishing progress made in the study of the parasitic fungi during the last quarter of a century

Its subject matter is principally the fungi themselves, and in character it partakes of the nature of a flora or diagnostic list, and a treatise on symptoms and therapeutics, with bibliographical references for those who wish to launch further into this particular arm of the sea of knowledge It is thus neither a complete treatise on the biology of fungi nor a detailed work on pathology, but—and in this reside its peculiar characteristics—a volume compiled to meet the wants of an increasing class of students who wish to know something of the parasitic fungi themselves and what plants they attack; something of the mode of attack and the symptoms induced; and something of the suggestions for combating the diseases which have been supplied by experiments in the field It is thus a typical example of a class of book evolved under the stimulus of the practical spirit of the age, and, in fairness to all be it said, of a high standard of excellence as scientific literature; further, it will be of no use to the crammer, to the examinee, or the dilettante, but must take its place on the shelf of the serious worker, the true naturalist, and the educated cultivator of plants as an indispensable work of reference

The book consists of two parts, of which the first contains chapters on the nature of parasites and parasitism. the reactions between host and parasite, infection predisposition, preventive measures, and the economic importance of the diseases of plants, together with a short summary of the facts of symbiosis.

The second, and far larger part, is devoted to a systematic account of cryptogamic parasites—the fungi proper, slime-fungi bacteria and pathogenic algæ being included The system followed is that of Brefeld, the saprophytic forms being omitted.

One fault of omission must be mentioned, if only in justice to those who have done good work in this country: the English literature is almost wholly ignored We hesitate whether to blame the author—who only follows the too common practice of continental writers—or the editor for this In any case the latter might have included references to Massee's and Somerville's experiments with *Plasmodiophora*, in his notes, to say nothing of other work by English botanists.

A feature in the work, which adds immensely to its value is the selection of photographic illustrations of the diseased plants themselves, showing how the victims of fungus attacks look. This is as near an approach to taking the student into the field and showing him the disease at work, as can possibly be made in at book; and when we reflect that this—so to term it—clinical study is as important for plant diseases as it is in the case of human diseases, its importance is obvious Few people are aware how much there is to be seen and learnt in the natural history of the disease of forest and field and garden plants, and Tubeuf's examples should stimulate botanists to pay more attention to the subject. It is true the reproductions of the photographs are by means of the detestable "process blocks," which disfigure most of the books of the present age; but I suppose we must agree that the choice lies between these or none, as prices and means go

It will be evident that the book is too large for even a brief review of more than the principal headings. but there are one or two features of importance which stand forth in salient contrast to anything met with in similar works.

These are signs of the times. One of the most striking is the far too meagre note on "selection of hardy varieties"—the word "hardy" does not accurately translate the original. From all sides we are now hearing that different varieties of vines, potatoes, wheat, &c., show different disease-resisting powers. and Tubeuf says, "An important method for the protection of plants from disease. . . . consists in the selection and cultivation of varieties and species of plants able to resist the attacks of parasitic fungi."

The very brief account of what has been done with the vine and the reference to what has been discovered about wheat, will only leave the reader hungry for more information

Another feature of interest and importance in Von Tubeuf's book, is the chapter on "preventive and combative measures," involving the treatment of diseased plants by means of chemicals. Here, again, I notice a lack of attention to the English literature: Berkeley, and other of our countrymen, had experimented with sulphur in various forms long before most of the authorities mentioned had taken the matter up. Still, it is quite true, the introduction of Bordeaux-mixture, and its employment on the enormous scale adopted in France, Australia, America and elsewhere, have taught us much, and suggested more. It is a common mistake to suppose that the intelligent application of remedial measures to plant-diseases does not pay—there are plenty of witnesses to the contrary; but, unfortunately, school and university courses generally have allowed of so little attention to the knowledge that must be utilised in carrying out such measures, that even skilled farmers, foresters, and other cultivators of plants, have to enter upon these experiments quite unequipped for carrying them out properly.

Tubeuf's chapter of the "economic importance of plants" may be cordially—if sadly—recommended to all who are interested in the very necessary extention of technical education by the institution of the agricultural school and colleges. He quotes the losses due to the Californian vine-disease (1892) at 10,000,000 dollars; in 1891 the wheat-rust cost Prussia over 20,000,000*l.*, and Australia something like 2,500,000*l.* Even allowing for large exaggerations—though reports from Sweden, India, Ceylon, the West Indies, and elsewhere suggest similarly large losses from fungus epidemics—in these estimates, it is evident that we have here to deal with annual losses of which even a saving of a very few pounds *per cent.* would be worth consideration; and the comparatively meagre experiments to hand, hold out hopes of much more considerable saving, if steps are taken in time, with a due and intelligant knowledge of the problems to be faced, and the methods of facing them.

This must suffice for our review of this excellent book, the technical details of which are well treated, of the highest importance, and abounding with interest to the naturalist and botanist as well as to the technologist and practical cultivator.

China or Indian Ink.

The Province of Wuhu, says Consul Fraser, produces the celebrated Indian ink more correctly called China ink (Encre de Chine), used by artists who paint in water colours. From here it goes to every part of China and all over the world. In 1895 about two tons of it were exported to foreign countries from Shanghai, valued at £564. It may be made in other parts of China, but the best comes from this province. The materials with which this beautiful black ink is made are the following:—(1) Sesamum oil, colza oil or the oil expressed from the large poisonous seeds of what Dr. Brettschneider calls the Dryandra cordata, or Elæococca verrucosa called by the Chinese Wu Tung, a tree extensively cultivated in the Yangtsze valley and also well known in Japan, (2) varnish, (3) pork fat. The lampblack made by the combustion of these substances is classed according to the materials and the grade of fineness, and also according to the time taken over the process of combustion. The paste made of this lampblack has some glue added and is beaten on wooden anvils with steel hammers. Two good hammerers can prepare in a day 80 pieces each weighing half a pound. A certain quantity of musk (of the muskdeer) or of Baroos camphor for scenting it and gold leaves are added, the latter, the quantity of which varies from 20 to 100 to to the lb. being to give a metallic lustre. The materials thus prepared are moulded in moulds of carved wood dried (which takes about 20 days in fine weather) and adorned with Chinese characters in gilding. About 30 or 32 average-sized sticks of ink go to the lb. The price varies from 2s. or less per lb. to so much as £7 per lb., there being over a dozen different grades. Nearly all writing is done by the natives throughout this immense Empire, in Japan Corea, Tonquin and Annam with this China ink rubbed down on a stone ink slab and applied with a paint-brush of sable, fox rabbit, &c., hair, set in a bamboo holder, and when not in use carefully covered with a protecting brass cap. The superior kinds of this ink appear to be used in China and not exported.

Kapok

Kapok is the Dutch name for the seed-hairs of the white silk-cotton tree *Eriodendron anfractuosum*, which grows throughout the East Indies, the variety from Java being regarded as the best. It is, however, too short in staple, too smooth, and too soft to be spun into yarn. Its chief use is for stuffing pillows, mattresses and sofas where its lightness, immunity from moth, its softness and elasticity render it superior to all but the best qualities of feathers, wool, and hair. A valuable account of this interesting natural product is published in the *Indian Agriculturist* for February 1897.

Eriodendron anfractuosum is a lofty forest tree, with a large straight trunk, covered when young, with prickles. The branches are horizontal and arranged in whorls. In Java, the growing trees are commonly used for telegraph posts, as the branches grow so conveniently at right angles to the trunk, that they do not interfere with the wires. The flowers are large and white, and are followed by dry cucumber-shaped capsules filled with black seeds embedded in silky hairs.

The seeds are sometimes eaten. They yield a bland fatty oil, the residual cake being used as a cattle food. In India the tree yields an almost opaque dark-red gum, which is said to be astringent and has been used medicinally. The wood is soft, and is used in tanning. From the bark there is sometimes prepared an inferior reddish fibre which is used locally for making ropes and paper. It possesses however no commercial value and the barking of the trees would not compensate for the injury done to them as a source of floss.

The kapok or floss is according to present demand, a fibre of considerable importance. It is said that its elasticity and harshness prevent it from becoming matted like the generality of flosses. It is important as pointed out by Dr Watt, to guard against an error 'made by many writers of viewing kapok as a generic trade name for all the silk-cottons—including that of the *simal*—the floss of *Bombax malabaricum*. When the demand for kapok first started Indian exporters placed on the market a quantity of very dirty *simal* having a large percentage of dust as well as seed. This was at once condemned and was sold at a price that would not cover the transport charges. India thus fell into an inferior position, which might have been avoided if carefully cleaned fibre had been sent to Europe.

Serious complaint is made in Australia and elsewhere of the quality of the kapok shipped from India. Even at the low price of Indian kapok (about 3d. per lb.) it is found better to pay 8½d. or more per lb., for kapok grown in Java. The former is frequently received in such a filthy condition as to be almost unsaleable. The hydraulic or steam press packing of kapok tends to destroy that peculiar elasticity to which it owes its value. In addition, the packing tends to express a dark-coloured oil from the seeds left attached to the fibre, and hence a noticeable difference in colour between the Indian and the beautifully white Java products.

At Java the trade has assumed a uniform practice. No unclean stuff is shipped, but the different grades of cleaning denote standards of quality, the first, 'extra cleaned,' is the first picking of the crop, and is cleaned by machinery, the second, denoted as 'best cleaned picked" being all hand-picked and free from seeds, except an odd one here and there, the third, is simply designated "cleaned." It contains a few seeds, together with the "slubs," or little knotty curly lumps, which are cast aside from the higher grades. Packing is all done in straw mats, and the floss is never tightly pressed.

The silk-cotton tree also grows in the West Indies, but for all practical purposes it is counted of little value. Considerable difficulty was at first experienced in the importation of silk-cotton, owing to its great bulk and the heavy cost of transport but this has been overcome by a silk-cotton press constructed by Stork and Company, at Henglo.

In the annual report of the Direction of the Botanical Department, Jamaica, 1884, the following remarks occur:—

"It now only remains for some enterprising firm to initiate the collection of silk cotton in Jamaica and to ship it in well packed bales for the European market. If each cotton tree yielded at the rate of about 100 lb weight of clean floss there might be exported from Jamaica every year about 3000 bales of silk-cotton of the value of £9,000."

In Ceylon, kapok is collected throughout the villages of the interior. The season commences in May and one crop is obtained each year, the tree reaches maturity about the fifth year.

Australia receives large shipments of kapok both from India and Java but it is difficult to obtain reliable statistics concerning the trade. It is entered at the local Customs under all manner of names, such as "vegetable fibre" "vegetable wool," "silk-cotton," "tree cotton," "raw cotton," and "small cotton."

So much attention is kapok receiving in the East Indies that the cultivation of the trees is even said to be ousting coffee in the province of Burma. Kapok has not been received in England on a very large scale, 100 bales a month are sent from India and Ceylon (1 bale = 200 lb Ceylon 400 lb Indian), and the price varies from 2½d to 4d per lb.—*Imperial Institute Journal.*

Non-Inflammable Wood.

An interesting demonstration.

A very practical test against fire of wood made non-inflammable by the process introduced by the Non-Inflammable Wood Syndicate, Limited, 2, Army and Navy Mansions Victoria Street, London, S. W., was given to H. M. Office of Works on Tuesday. The demonstration, which took place on the site of the old Millbank prison at Westminster, was witnessed by the Prince of Wales and many of the leading architects and builders of London. Two buildings precisely alike in all essential respects, were erected by Messrs. John Mowlem & Co. one of which was constructed of ordinary building timber, and the other of timber made non-inflammable by the new process. The kinds of timber entering into the construction of both buildings were the same, viz., the frame and covering of pine ; the interior finish of ash, oak, birch, and mahogany Both buildings were attacked simultaneously by flames produced by setting fire to equal quantities of dry timber thoroughly saturated with petroleum stacked against the sides of the two buildings The result was most interesting. The untreated building was quickly enveloped in flames, and before very long completely gutted The treated building, on the other hand, remained practically unaffected by the heat. An attempt was afterwards made to fire the treated building by piling up dry timber, thoroughly saturated with petroleum, against its inside walls and setting fire to it, but the blaze inside failed to kindle the walls of the building, which resisted every endeavour to set it alight The process by which this wood is rendered uninflammable consists of a series of careful manipulations whereby the timber becomes uniformly impregnated throughout its entire bulk and texture with a fire-resisting compound, after the natural juices of the wood have been removed from the wood cells and vessels, which securely protects it from all danger of combustion And this protection, too, is permanent, since the fire-proofing substance with which the cells and tubes of the wood are impregnated is not affected by any change of climate or temperature , in fact, age adds to the degree of firmness with which the fire-resisting crystals adhere in the cells of the wood It should be stated, moreover, that the fire-treating compound is colourless, odourless, and absolutely harmless to health. It does not attract moisture , it does not discolour the wood ; it does not affect materially the working of the wood , it merely adds a little to its weight In general it may be stated that treated wood can scarcely be distinguished from non-treated wood It is also stated that the treated wood is largely protected from dry-rot, insects, worms, &c

The wood treated by this process, it should be added, appears to have no effect on the tools, as far as sawing, planing, &c., are concerned and it is as easily worked as ordinary wood.

The War Department of the United States is about to adopt the process for the treatment of all timber to be used in ammunition stores, forts, barracks, &c. The Japanese Government has also adopted it for the treatment of all timber entering into the construction of the two cruisers now being built for that country in United States ship-yards In addition to this, several of the newest and largest office buildings in New York City have no wood used in their construction except that fire-proofed by this process. Many leading architects of the United States are likewise specifying wood treated by this process.

Already plants for treating wood are in operation in New York City, Newport News, and San Francisco, and others are being erected in Philadelphia, Chicago, and other cities. A plant capable of treating large quantities of timber is now being erected in London.—*Timber Trades Journal.*

Monograph of Indian Bamboos.

The Government of India has recently issued a circular inviting attention to the publication (as Volume VII of the Annals of the Royal Botanic Garden, Calcutta) of a monograph of Indian bamboos, by Mr J S Gamble M A of the Imperial Forest Service The book has received the highest commendation from Sir Joseph Hooper, and contains an account as well as an illustration, of every known species of bamboo found in the Indian Empire The price of the book is we understand Rs 14 Copies are procurable from the Superintendent of the Royal Botanic Garden

A Forest School for Burma.

We are glad to hear that there is some probability of effect being given to the proposal to establish a Vernacular Forest School in Burma for training recruits for the executive staff of the Department, the necessity of which has long been admitted The new school will probably have its head-quarters at Tharrawaddy in the Pegu circle

Schlich's Manual of Forestry.

We would invite the attention of our readers to the reduction in the price of Dr Schlich's Manual of Forestry, as advertised on the cover of this number

VII TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

4th May, 1897.

East India Teak.—The deliveries for the first five months of the year amount to 8,401 loads, against 9,592 loads, in that period of 1896. In May, 1897, they were 1,645 loads, and in May, 1896, 2,411 loads. A certain dulness has overtaken the market: prices in London are quietly maintained, but the volume of business is not quite satisfactory. Floating cargoes are sold so far ahead that they are not easily affected one way or the other but fears are felt as to the ultimate effect of shipments of inferior wood attracted to European markets by the rise in price. This effect, if felt, must be transitory; unless sold profitably such shipments must promptly cease, and in any case, they can be to a large extent detached from regular shipments. So long as the existing condition of affairs political continues, the demand for good wood will absorb the supplies.

Rosewood —East India.—is in good demand at steady prices, but shipments must not be large.

Satinwood—East India—For *Figury* wood there is a good demand, and both *logs* and *boards* sell well, but for plain wood there is very little enquiry.

Ebony.—East India.—Small parcels of good logs would bring fair prices.

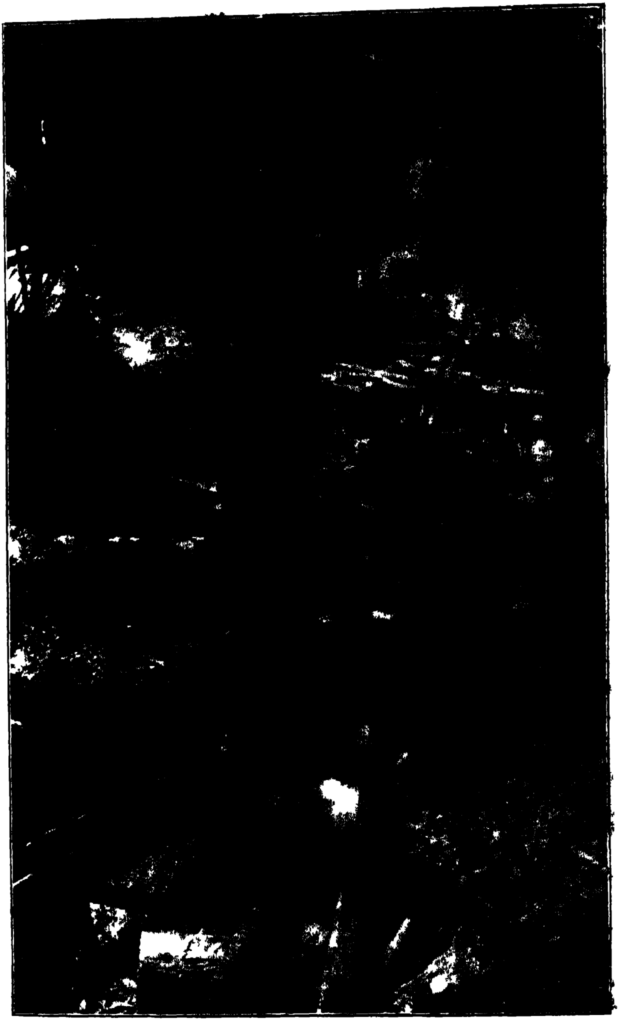
PRICE CURRENT.

Indian teak	per load	£11	to	£16
Rosewood	,, ton	£8	to	£10
Satinwood	,, sup foot.	8d.	to	12d.
Ebony	,, ton	£7	to	£8

MARKET RATES OF PRODUCE.

Tropical Agriculturist, June, 1897.

Cardamoms		per lb.	3s.	to	3s. 1d.
Croton seeds		per cwt.	85s.	to	86s.
Cutch		,,	9s. 3d.	to	32s. 6d.
Gum Arabic, Madras		,,	35s. 6d.	to	40s.
Gum Kino	,,	,,	£45	to	£55.
Indiarubber,	Assam	per lb.	1s. 9d.	to	2s. 4d.
,,	Burma	,,	1s. 4d.	to	2s. 1d.
Myrabolams,	Madras	per cwt.	3s. 9d.	to	5s. 6d.
,,	Bombay	,,	4s. 3d.	to	8s. 6d.
,,	Jubbulpore	,,	4s.	to	7s.
,,	Calcutta	,,	4s.	to	6s.
Nux Vomica, Madras		,,	7s.	to	7s. 6d.
Oil, Lemon Grass		per lb.	2⅝d.		
Orchella, Ceylon		per ton	10s.	to	12s. 6d.
Sandalwood, logs		,,	£30	to	£50.
,,	chips	,,	£4	to	£8.
Sapanwood,		,,	£4.	to	£5.
Seed lac		,,	70s.	to	80s.
Tamarinds		,,	7s.	to	8s.



essed by Thacker Spink & Co

THE

INDIAN FORESTER.

Vol XXIII] August, 1897. [No. 8.

The Export Works in the Bamsu Forest, Jaunsar Division, School Circle, N.-W. P.

The Bamsu Deodar Forest which is leased from the Rajah of Tehri Garhwal, is situated on the right bank of the Tons River, and comprises an area of 2 323 acres

The stock consists mainly of Deodar with a mixture of Rai (*Picea Morinda*) Morinda (*Abies Smithiana var Pindrow*) and Kharsu oak *Quercus semecarpifolia* in the upper portions and of Kail (*Pinus excelsa*) and Ban oak (*Q incana*) in the lower portions.

A Working plan for this and the neighbouring deodar forests leased from the Rajah of Tehri, from 1885 to 1905, was drawn up by Mr Hearle, Deputy Conservator of Forests, and came into force from 1st April 1885

The main provision of the working plan is that not more than 2 000 *green* deodar trees are to be felled annually, from the blocks set aside for the corresponding period, together with all available *dry* deodar trees from the areas in which the green trees are felled.

In accordance with the provision of this plan, work should have commenced in Bamsu during 1892-93, but owing to the disaster to the Deota slide and other causes, the work in the Deota forest was delayed and fellings in Bamsu did not commence till 1893-94.

The total number of 1st class trees *i. e*, those over 6′ in girth contained in the Bamsu forest, according to the valuation survey made, amounts to 12,725, besides which there are 11,029 *2nd* class trees *i. e*, those from 3′ to 6 in girth.

Under the provisions of the working plan 6,000 1st class green deodar trees were authorized to be felled, but the actual number cut has only amounted to 5,799 green and 3,020 dry trees, the felling and sawing work having been completed in December, 1896.

The total outturn from the above trees has been as follows —

		c ft
Broad gauge Sleepers	10¼ × 10¼ × 5¾	31,465
Metre gauge Sleepers	6¼ × 8¼ × 4¼	3,98,109
Karis 10 × 5 × 4	6 × 5 × 4″ ..	1,592
		4,31,166

The average distance of the Bamsu forest from the Tons river is about 7 miles, the line of export which is along the gorge, being interrupted in the middle by a precipice and waterfall of about 500 feet perpendicular height

It had at first been intended to construct two sections of water slide with a wire rope shoot down the precipice but the fate of the Thadior slide in August 1889 and the great success of the Deota and Thadiar sledge roads decided the adoption of the latter method of transport

The upper and lower sections of the Bamsu khud presented no great difficulty in the selection of a good line for the sledge road but the lower portion of the upper section called the Bamsu gorge where the stream dashes through a precipitous defile for a distance of 2,000 feet presented almost unsurmountable difficulties A good line was however eventually found and laid out principally by Pundit Rama Datt Forest Ranger, under whose direct supervision the works have been carried out

The total estimate for the works including buildings wire rope shoot &c amounted to Rs 18,837 against Rs 22,7[illegible]0 proposed by the framer of the working plan but owing to the exercise of economy and careful supervision the actual cost amounted Rs 14,604 only

Subsequently during 1895-96 a short length of water slide aggregating 3,450 feet was added above the upper section, at an additional cost of Rs 1,188

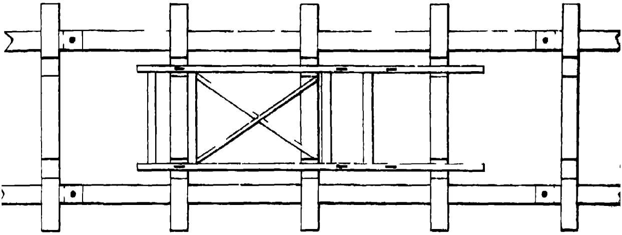
The construction of the sledge road was commenced in November 1892, and completed by the middle of July 1894 and the following is a general description of the work, and the order in which it was undertaken

I Cutting and sawing the timber required for the bridges and roadway the work having been started as early as possible in order to allow the timber to season before being used

II Cutting and embankment work which was very heavy This part of the undertaking it was important to complete as early as possible, so that during the rains of 1893 the embankments might settle themselves and the unavoidable landslips which happen on all new roads in the hills might take place without damage to the roadway when laid

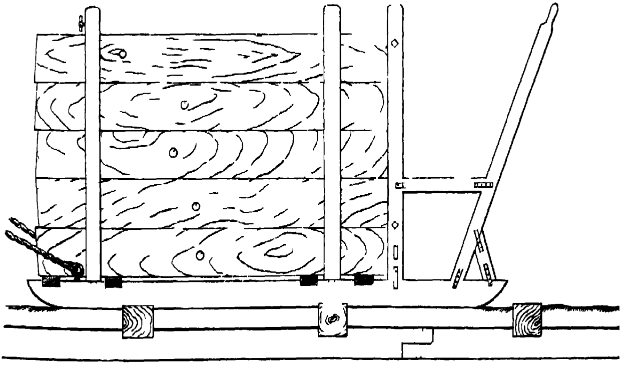
III Blasting operations, which were very heavy, and which it was important to do by degrees thus avoiding unnecessary work which often takes place if done in a hurry

SYSTEM OF ROADWAY AND SLEDGE USED ON THE BAMSU SLEDGE ROAD



PLAN

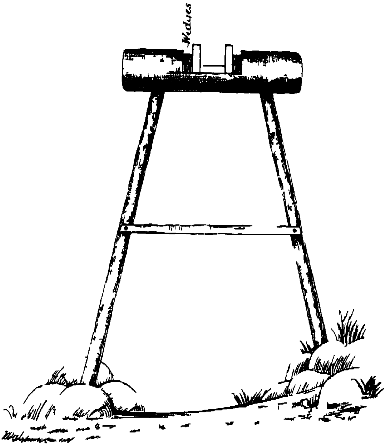
Scale 3 Feet=1 Inch.



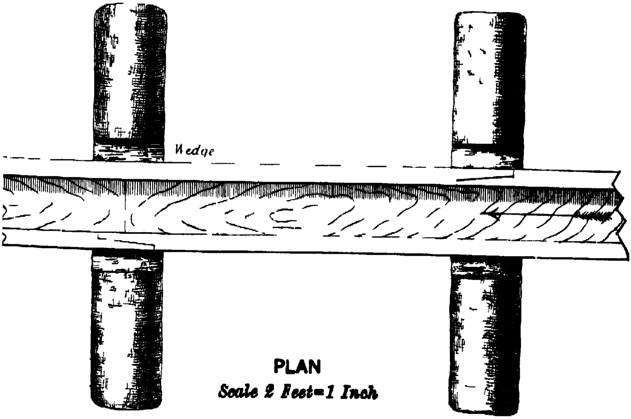
ELEVATION

Scale 2 Feet=1 Inch.

BAMSU WET SLIDE



SECTION
Scale 4 Feet=1 Inch



PLAN
Scale 2 Feet=1 Inch

IV Construction of the piers of the main bridges, which were all done by skilled masons, and on daily labor under proper supervision

V Laying down of about 3¾ miles of timber roadway, the work having been commenced from the top, so that the sledge road was used for the transport of a good deal of the timber required for the middle and lower sections, and thus a considerable saving was effected on the cost of carriage by means of coolies.

VI Laying the beams and completion of 57 timber bridges on both sections of the sledge road

VII The erection of the wire rope shoot in three spans, having an aggregate length of 182[illegible] ft and a total fall of 881 ft down the precipitous ground below the Bamsu gorge

The Bamsu sledge road has been constructed in two sections, called the upper and the lower, as it could not be made continuous on account of the presence of a stupendous cliff and a waterfall in the middle already referred to

As stated above the interval between the upper and lower sections consists of a series of precipices having a total fall of 881 ft. down which a three span wire rope shoot, with an accompanying carrying tram and rough track, have been successfully constructed

The general nature of the Bamsu sledge road is similar to the Deota and Thaliar sledge roads of the Deota range constructed in 1884 and 1889 detailed descriptions of which are contained in printed reports dated September 1885, and April 1890

For those who have not seen these reports the following brief description with the accompanying diagrams may be of interest

The Bamsu sledge road commences at a convenient point in compartment I of the Dhikuri Block the depôt where the road begins having been selected on account of its being the central point to which most of the timber from the upper part of the Forest had to be carried

From this point the sledge road follows the Bamsu stream where the ground was found to be fairly easy, to the entrance of the Bamsu gorge already described

The total length of the upper section which terminates on the edge of the cliff where the wire rope shoot has been constructed, is 9 819 feet and includes 2,200 feet constructed in the rocky Bamsu gorge

In this part much blasting had to be done and the stream has been crossed seven times in order to avoid heavy rock cutting

The total length of the 16 bridges on the gorge portion of the upper section aggregates 1 600 feet

The lower section of the sledge road commences at the foot of the cliff at the place where the wire rope shoot terminates, and runs down through fairly easy ground to the bank of the Tons at the Mora depot where the sleepers are stacked and launched.

The work on this section was much easier than on the upper part of the sledge road, but still there was some heavy blasting work to be done near bridge No. 6 and the stream had to be crossed six times on this section

The length of this lower section of the sledge road is 9,551 ft. and the total length of both sections, including the branches at the depôts aggregates 19,370 feet or 3¾ miles, as compared with 1⅛ miles of sledge road first constructed at Deota, and 1½ miles afterward constructed at Thadiar in the same Range

The total number of blasts exploded was 3,456 and the amount of powder used amounted to 754 lbs It is satisfactory to be able to state that no accidents of any importance occurred during the progress of the blasting work

The drainage of the sledge road has been carefully attended to the water being let off below the roadway by a system of rough troughs

There are in all 57 main bridges and viaducts on the Bamsu sledge road the aggregate length of which is 3,894 feet

The principal and most difficult bridges to construct were Nos 2, 16, 21 and 23 all on the upper section

Bridge No 2 has been constructed in an especially awkward part of the Bamsu gorge the large beams supporting the roadway being fixed into the rock on each side a task of no little difficulty

In all dangerous places strong railings have been erected on both sides of the bridges and have been found most effective in preventing accidents

The wooden roadway over which the sledges run consists of longitudinal beams generally 12 or 10 feet long by 5 by 5" placed 2 9" apart and connected by means of transverse beams 5 to 5½ long by 5" by 4 spaced from 2½ to 3 apart according to the gradient of the road

In the transverse karis or beams are cut nicks, from 6" to 10 wide and ½ deep in which the sledges run When these nicks become too deeply worn, a piece is cut out of sleeper or kari, and the place is filled by a loose piece carrying a new nick at the correct elevation These loose pieces, instead of being rectangular, have one side coned and are inserted from the rear, so that the friction of the sledges always downward, keeps them tight up to their seat

The longitudinal pieces and cross beams are all joined together by means of strong moru oak (*Quercus dilatata*) pegs and the whole roadway is firmly embedded in good ballast

The gradient of the sledge road varies from 4° to 11½° or from 1 in 14 to 1 in 5½, the average being about 6 degrees

On steep gradients in order to restrain the velocity of the sledges, the cross pieces are placed 3 feet apart and rough grained timber such as chir (*Pinus longifolia*) is used, whereas on low gradients the cross bars are placed 2 feet apart and fine grained hard timber such as tun, shisham, &c, is used, deodar being employed on intermediate gradients A great economy in the use of oil and soap has thus been effected by the perfecting of these simple but important arrangements

The sledges employed on the Bamsu sledge road are somewhat larger than those used on the Deota and Thadiar sledge roads, but are built on the same plan, as represented in the accompanying diagram

The large sledges used for sledging B G sleepers are 11 feet long and 2 4 wide whereas those used for sledging M G sleepers are the same breadth but $9\frac{1}{4}$ long only

The scantling of the runners of the sledges is $11 \times 4\frac{3}{4}'' \times 1\frac{3}{4}$ and $9\frac{1}{2} \times 4\frac{1}{4} \times 1\frac{3}{4}$ and the best timber for the runners is found to be the two local oaks called Bani (*Quercus annulata*) and Morú (*Quercus dilatata*) but shisham is also used for the upper bars and handles of the sledges

The sledges are constructed to carry 15 B G or 25 M G, the dead weight being over a ton

The sledges are worked by two men it being the principal duty of the man in front to guide the sledge into the grooves also to pull or restrain the sledge according to the gradient , whilst the man behind moderates the pace of the sledge by means of a rope attached to two iron rings or pushes it forward as necessity arises

At first the sledge men after reaching the lower depôts and depositing their freight dragged the sledges up again along the road but this plan was soon given up for the easier one of carrying the sledges upon their shoulders

Many suggestions for brakes or drags have been made but no practical arrangement except the free use of sand on the steep gradients has yet been arrived at

The effect of very wet weather on the sledging is that there is considerable difficulty in starting the sledges even on steep gradients , but when once started they tend to bolt , so that at such times sledging is either altogether prohibited or permitted only on the condition that three men two behind and one before, take charge of each sledge

The working of the Bamsu sledge road has been found to be the most satisfactory of the three sledge roads constructed in the Deota Range and this is mainly due to the extra care bestowed on the laying out and careful perfecting of the roadway also to the kind of timber used as already explained, and to the use of beds of sand on the steep gradients, which act in a most effective manner in checking the velocity of the sledges when passing over them

Only two serious accidents have occurred during the working of the sledge road, which resulted in two men being killed, but the accidents were mainly due to the men s inexperience and carelessness and not to any fault in the construction of the road.

The following is a statement of the financial result of the Bamsu sledge road from the commencement of its working in April 1894 up to the end of March 1897

The total number of M G and B G sleepers and of other pieces of timber transported during that period amounts to 3 57,104 The actual cost of the sledge road, amounted to Rs 14,604

The actual cost of working down the above timber by means of the sledge road stands as follows —

		Rs
Actual cost of sledging the above timber amounts to	.	12 316
Add cost of making and repairing sledges	.	1,491
Ditto repairs to sledge road	.	1,145
Miscellaneous items oil, soap &c	.	837
Total	Rs	15 789

The total expenditure incurred on the sledge road including original cost &c is therefore Rs 30 393 Now had the above timber been transported over the same distance *viz* 3¾ miles on coolies' backs, the actual cost would have amounted at least to Rs 97 867 Therefore the net financial result of the Bamsu sledge road up to the end of March 1897 is a gain of Rs 97 867—30 393
or Rs 67 474

As a lakh of sleepers have yet to be transported by its aid, the ultimate saving effected by the use of the Bamsu sledge road instead of coolie carriage, will probably amount to about one lakh of rupees.

The Bamsu wire rope shoot which connects the upper and lower sections of the sledge road consists of three spans having an aggregate length of 1 825 feet

The total fall is 881 feet and the spans and gradients are as follows —

No of Spans		*Gradients*	*Vertical height*
I	634 feet	26 degrees	274 feet
II	759 ,,	31½ ,,	402 ,,
III	432 ,,	27 ,	205 ,,
Total	1,825 feet		881 feet

The wires used consists of Bullivant's patent steel ¾ inch diameter wire ropes, which combine strength and durability with lightness and are far superior to the ordinary galvanized iron wire ropes though more expensive

On the first and third spans a single wire is the means adopted, but on the middle section, which is the steepest, a double endless wire running round two wheels or drums with their axles approximately vertical, has been employed, and works satisfactorily

On the upper and lower spans the sleepers are attached to the wire ropes by means of moru oak saddles which reduce the wear and tear of the wire caused by the friction to a minimum and are found to work fairly well At first it was intended to use soft iron hooks or saddles as in the case of Dandot Colliery wire rope shoot in the Punjab, but the oak saddles are found to be preferable

At the lower ends of the spans the ropes are given the proper tension by means of rough winches to which the ropes are firmly attached

The middle section as already stated, consists of a double or endless rope passing round two wheels, this arrangement being adopted on account of the gradient having been found too steep for the single rope system

To the rope are firmly attached two cars, the loaded car, carrying four M G sleepers hauling up the empty car, which is then loaded and sent down from the other side of the wheel

The working of the single wire rope sections is found to be fairly satisfactory but occasionally the sleepers fall off through the sudden breaking of the oak saddles or some other mishap also if the tension of the wire happens to be too great they occasionally get smashed against the timber barriers erected at the lower end of the spans

The working of the middle section is found to be the best and though somewhat slower fewer breakages take place

The total carrying capacity of the Bamsu wire rope shoot 250 sleepers per day only, and as the wire ropes began to show signs of wear and tear after about 20 000 sleepers had been slid the work was discontinued especially since it was found that the cost of carriage by means of coolies over the same sections amounted to about the same cost viz 8 pies per sleeper The breakages and damage in the case of the wire rope shoot also amounted to about 6 per cent whereas in the case of coolie carriage it is nearly nil Under the circumstances therefore, the shoot was abandoned, but its use has had the effect of reducing the cost of coolie carriage from one anna to 7 or 8 pies per sleeper and has therefore resulted in a considerable saving

It has been already mentioned that after the completion of the sledge road wire rope shoot, it was found desirable and practicable to construct a length of wet slide or "flume" to join the upper end of the sledge road in the Bamsu khud.

The total length of the wet slide, which was completed in July 1895, is 3,450 feet and the original cost amounted to Rs 1,188

It is constructed on the same principal as the old Thadiar slide which was used for about 10 years for the export of timber from the Deota Forest, but instead of high and expensive retaining walls, which often shook down, a system of rough trestles has been employed for supporting the slide, and these have been found much cheaper and more satisfactory.

The slide consists of a rough trough formed of three planks measuring from 6 to 10 long by 11″ wide and 3″ thick, the inside measurement of the slide being 11″ by 8½

The beams are roughly jointed but no nails are used, and the accompanying diagrams represent the nature of the wet slide

The slide is firmly wedged into block sleepers or small logs 6 long by 15 diameter placed at intervals of 5 to 6 apart, these' being supported on rough trestles or embedded in rubble masonry, according to the nature of the ground

The maximum gradient of the slide is about 20 degrees and the minimum 5 degrees

The timber used for the beams of the slide is kail (*Pinus excelsa*) and for the trestles and block sleepers any kind of common wood such as oak, chestnut birch &c

A plentiful supply of water is required to work the slide and this is let in at intervals of about 200 yards according to the gradient and leaky condition of the slide

A rough method of caulking is effected by throwing in dead leaves which fill up the joints

The M G sleepers are launched on their broad sides, and B G sleepers on their narrow sides the pace at which they travel naturally depends on the gradient and amount of water available, &c

As jams sometimes take place a number of chaukidars are stationed along the slide to help the sleepers along

These jams are due to the following causes —

1st —Stones getting into the slide

2nd —One sleeper travelling on its narrow surface getting alongside of another on its broad side

3rd —Insufficiency of water due to drought leakage, &c

At the Bamsu forest sufficient water remains in the khud to work the slide for about nine months in the year, but at the old slide in the Thadiar khud of the Deota forest the working season only lasted from 15th June to 15th October and again for a month during March after the melting of the snow

From July 1895 up to March 1897, the following timber has been slid at Bamsu

M G sleepers	=	172,000
B G ditto	=	9,800
Karis	=	6,000

The financial result may be represented as follows —

Cost of carrying the above timber on men's backs over the length occupied by the slide at various rates Rs. 6,080.

Deduct

(*a*) Original cost of slide	Rs	1,188	
(*b*) Cost of working down the above timber by means of the wet slide	„	1,270	
(*c*) Repairs, improvements, &c ..	„	222	
Total ...	Rs	2,680	2,680

Net gain in favor of the wet slide ... ... Rs. 3,400.

As there are about 50,000 sleepers still to slide, the net financial result will probably amount to about Rs. 4,500 net profit.

Mention has been made above of the old Thadiar slide; for those who are unacquainted with its former existence and untimely fate, the following brief description may be of interest

The old slide was situated in the Thadiar khud which drains the Deota forest, the total length being 12,000 feet and original cost Rs. 26,000

It was constructed in 1878 on much the same plan as the Bamsu slide above described except that a large expenditure was incurred on retaining walls, rock cuttings and tall masonry piers which very often came to grief from the action of floods vibration of the slide, &c

The Thadiar khud having a large catchment area of steep hill sides running up to 10 000 feet, is subject to sudden floods, landslips, &c, so that the slide was continually getting damaged by floods, falling rocks, boulders, trees &c, and was a source of constant anxiety to the officer in charge, especially during the rains. On the other hand the Bamsu slide being situated high up near the source of the Bamsu khud, is not nearly so liable to damage from floods as the Thadiar wet slide was, and therefore works much more satisfactorily, also being situated in the cooler climate, the timber is not liable to shrink and warp half so much at the Thadiar slide which became unfit for working unless there was a large supply of water available to counterbalance the leakage, &c.

However, the Thadiar wet slide may be said to have worked well for about 10 years the financial result up to the date of its total destruction on the 8th of August, 1889, being estimated at Rs 38,000

As the readers of the *Indian Forester* of that period may have forgotten a description of that catastrophe given in one of the numbers of that time, the following is a brief account of what actually happened

About 6 p m on the 8th of August, the year above stated, a furious storm burst on the Deota ridge, 6 inches rain having been registered in a few hours

About 10 p m a tremendous flow of water, mud and *débris* of all kinds, reached the head of the slide, the water, from the marks left on the banks, having been about 40 feet deep

This flood swept down the valley in a series of rushes, caused by the temporary damming up of the khud, at narrow places, and in the course of a couple of hours it completely wrecked and carried into the Tons river nearly the whole of the timber slide, notwithstanding the fact that it was in some places situated 50 feet above the stream. The catastrophe was unfortunately accompanied by the death of 12 choukidars who were asleep in a cave near the head of the slide 20 feet above the stream Their bodies were never recovered having been apparently ground to paste in the mud and boulders

The transporting power of the torrent was enormous, large boulders weighing from 20 to 100 tons having been carried along for hundreds of yards, by means of the mud, which being afterwards washed away, these boulders may now be found deposited high and dry along the bed of the Thadiar Khud About 36 000 sleepers were also washed into the Tons River from the Thadiar Depôt Of these about 10 000 were never seen again, and the total loss caused by the flood amounted to about Rs 40,000, together with the 12 lives referred to

As regards the comparative merits of sledge roads, wet slides, and wire rope shoots, the experience gained in the Jaunsar Division of the School Circle tends to demonstrate as follows —

That sledge roads are by far the most reliable means of transport because they are not so liable to be damaged by floods and landslips as wet slides and can besides be worked all the year round The carrying capacity is practically only limited by the number of sledges and men employed, whereas the working of wet slides entirely depends on the amount of water available at different seasons on the leakage, &c

Sledge roads are also a most popular means of transport with the hill men, and quarrels sometimes take place amongst the coolies as to who are to be allowed to use the sledges

Regarding the use of wire rope shoots the experience gained in the Jaunsar Division, is too limited to enable a decided opinion to be given as to their general suitability in the forests of the Himalayas but as far as the experiment tried at Bansu goes this aerial structure is unpopular, decidedly difficult to work, causes breakage and damage to a good many of the sleepers and in this particular case was no saving in the cost of transport over ordinary coolie carriage, except that its construction had effect in causing the coolies to lower their carrying rates over that particular section of the line of export

D McA M

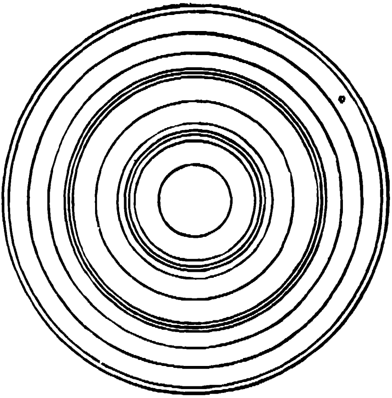
II.—CORRESPONDENCE

Extraordinary Irregularity in the growth of Teak. What is the cause ?

During the past working season while engaged on Working Plans, I had occasion to count the rings on some 343 teak stumps and it was impossible not to notice the extraordinary irregularity in the growth as exhibited by the rings

Ordinary irregularities, of course, occurred in plenty, but what I now wish to draw attention to, is the curious way in which cycles of normal and abnormally slow growth alternated in I should say, 75 per cent of the stumps counted The accompanying diagram will illustrate my meaning, the distance between each concentric circle being supposed to represent 10 years' growth

Suppose, for instance the inner rings exhibited fairly normal growth After a number of years the rings become so crowded together, as to be difficult, if not impossible, to count with certainty. Then after a period varying in each case, but generally somewhere beetwen 10 and 40 years the growth again become normal



and continues so for some years, only, perhaps, to again become very slow There may be only one cycle of slow growth during the life of the tree (excluding, of course, slow growth due to advanced age) or there may be more The general number is two or three, but four were noticed on two or three occasions. The duration of the cycles of slow growth also varied considerably ; in some cases they extended over 40 or 50 years but the most common period was 20 – 30 years

Summarising shortly, the growth of the whole tree consisted of alternate cycles of normal and abnormally slow growth, each cycle (both of normal and abnormal growth) extending over a varying, but generally considerable, number of years.

In the forest examined, at any rate, there can be no doubt about the fact that the cycles of slow growth have occurred and are probably still occurring, but what is the cause to which they must be attributed? Reduction in the rate of growth evidenced by narrow rings can generally be attributed to one of three causes *viz.*—

(1) Damage by insects.
(2) Crowding and overshadowing by faster growing trees.
(3) Damage by fire.

No. (1) may be left out of consideration altogether, the length of time over which the damage extends rendering it absolutely impossible that insects should be the cause. No. (2) without doubt explains the damage in some cases, but it seems to me that in the majority of cases fire is the cause of most of it. My reasons for coming to this conclusion are as follows :—

(*a*) The suddenness with which the change from normal to very slow growth takes place.

(*b*) The very large proportion of trees exhibiting this appearance

(*c*) The occurrence of 2, 3 or even 4 cycles of slow growth during the life of the tree. None of the arguments can be said to tend in any way to prove that fire is the cause of the damage, but they are negative arguments against the cause being overshadowing or crowding. If the latter were the cause, the change from normal to slow growth would be more gradual, and it is incredible that so large a proportion of trees could suffer to such an extent several times during their lives.

On the other hand, the very long periods during which the growth continues slow, and also the number of years separating the cycles of slow growth would appear to be a very strong argument against the damage by fire theory. At first sight it would appear impossible that fire could so damage a tree for, say, 20 to 30 years, and then suddenly cease to have any (or much) effect for, say, another 20 or 30 years. The condition of the undergrowth may, however, have something to do with it. A ground fire burning only leaves, does comparatively little damage to anything but seedlings. It is different when there is on the ground, as there is at present, a strong growth of young bamboos principally Tinwa (*Cephalostachyum pergracile*) but often Wa-nwè (*Gigantochloa albociliata*). In such undergrowth fires are fierce, the young bamboo shoots are burnt down year after year and, of course, trees of all sizes suffer considerably. This might explain yearly (or almost yearly) damage by fire extending over considerable periods and then suddenly ceasing, * only to recommence again when a new crop of young bamboo appears on the ground. It is impossible to explain such even, but abnormally slow growth, except by moderate injury frequently repeated (in the case of overshadowing it would be continuous), and assuming fire to be the cause, such damage is in this way quite possible.

I do not know whether this matter has been noticed and written about before, but if so, I should like to know to what cause the damage was attributed. Whatever the cause, the damage exists and is undeniably great, *e. g.* suppose under present circumstances the number of years required for a tree to obtain 7 feet girth is 180 years, and suppose also that the tree has during its life passed through two cycles of slow growth each of 25 years. One normal ring may be assumed to be equal to 5 abnormal ones (a very low estimate) so that if the growth had been normal throughout, the tree would have attained a girth of 7 feet in 140 years That is, remove the cause of damage and the age of maturity (of this particular tree in this particular case) could be reduced by 40 years.

This letter has extended much beyond the limits I at first intended, but the matter is an important one. Further investigation is necessary, and should it result in establishing fire as the cause of even much of this damage, it will only add one more strong argument in favour of fire protection, especially in bamboo forest, which, at one time or another, must have a crop of young bamboo on the ground.

One more point. The results obtained with Pressler's borer on teak in bamboo forest must be uncertain and consequently of little value.

S. C.

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* But why should it cease suddenly ?

HON : ED:

Our correspondent describes a peculiarity in the growth of teak which has long been a puzzle. That it is in some way connected with the associated bamboos seems more than probable. Possibly the crowding of the root system of the teak trees by bamboos, may have had something to do with it, but the usually abrupt commencement of the period of slow growth is rather against this theory It would be interesting to ascertain whether alternating periods of slow and rapid growth are found in forests in which there are no bamboos, but in carrying out any such investigations in this direction it must be recollected that many forests which now contain no bamboos, have not always been in this state. There seems no reason why the occurrence of trees with alternating cycles of growth should invalidate the results obtained by Pressler's growth gauge, provided the latter is properly used : in fact it is only by the use of the gauge that the phenomenon can be satisfactorily studied, as without this instrument it would be difficult to find the trees which are at present in the slow stage of growth.

HON. ED.

The Number of Acres in a Cape Morgen.

With reference to the request contained in your review of the Cape of Good Hope Forest reports (p. 139 of "Forester" for April last) that some one will turn the Cape morgen into acres, I beg to inform you that one morgen (Dutch measure) = $2\frac{1}{9}$ Eng. acres.

KNYSNA
3rd July, 1897.

A. W. HEYWOOD,
Conservator of Forests.

IV.—REVIEWS

Forest Administration in the Northern and Central Circles of Bombay during 1895-96.

NORTHERN CIRCLE.—The forest area has been decreased by 8,464 acres, leaving the total area at 2,297 square miles and 113 acres. The Murbad and Shahapur talukas were settled and demarcated but the orders of Government have not yet been issued. The Forest Settlement Officer and his staff cost nearly Rs. 18,000.

In Surat a revision of the settlement in Mandvi Taluka was begun. No reasons are alleged as justifying the step. Demarcation was done to the extent of 130 miles of lines and about 1,250 cairns at a cost of Rs. 14 per mile. The demarcation of the Dangs is still, as it has been for the last ten years, in difficulties, owing to the objections of the inhabitants. This is a mountainous region of some 600-700 square miles at the junction of the Syhadris, or Western Ghauts, and the Satpuras. It is a confused mass of petty independent states about the size of a jaghir. The forests have been leased from the chiefs ever since the days of John Company or thereabouts and the people have always been most willing to assist in working out the forests, but have always objected to any planting. Several officers have tried their hands at a Working Plan demarcation and two or three times the consent of the chiefs has been obtained by the assistance of increased subsidies, but always repudiated when any attempt to carry them out was made. The fact is that the people are wedded to 'Kumri' or shifting cultivation, and will never willingly consent to be kept out of a single acre. In the meantime the forests, already deprived of large timber by many years of contractors, are going from bad to worse, although the region is an ideal one for the largest forests of perhaps the finest timber in India. Few men in the service now can remember the coast woodyards choked with logs 3 feet square of a density and toughness unsurpassable What is urgently wanted now is fostering care and protection but it looks as though the whole region were doomed to destruction and the task of the local officers is no enviable one

Forest Surveys on the scale of 8 inches to the mile were carried out over 41 square miles at a cost of Rs 168 per mile A Working Plan for the Kalol Range of the Panch Mahals Division was sketched out by Mr Millett and is being discussed by the Revenue officials, who are really the only authorities on such work in Bombay

“ This year a commencement was made in transferring the ‘direct supervision of coupe marking work to the Divisional ‘Establishment In those ranges where coupes in advance had been ‘marked on the ground 2 surveyors were placed at the disposal of ‘the Extra-Assistant Conservator and the actual work of picking ‘up the boundary stones of the coupe of the following year and fill‘ing in the boundary with stones at short intervals and trees ‘marked with red paint was left to be done by them under the ‘supervision of the Sub-Divisional Forest Officer The remainder ‘of the coupes for the coming year were marked out by surveyors ‘under the direct control of the Divisional Forest Officer, Working ‘Plans as in previous years and by the Forest Survey

‘ In this way 275 coupes for exploitation during the season ‘1896-97 were marked on the ground representing an area of ‘15 315 acres at an average cost of Rs 4-15 3 per coupe or 1¼ ‘annas per acre

In addition to this 370 coupes in advance were marked out in the Bhiwndi Bassein and Mahim Ranges And further 1 077 ‘coupes were similarly marked out in the Vada Range by the ‘Forest Survey at a cost of Rs 1 096 1-11

Thus the balance of coupes remaining to be marked out which ‘last year was reported to be over 9 000 is now reduced to about ‘7 000 Less than 2 500 of these are however ready for marking ‘out Of the remainder 4,300 are situated in the Murbad Shahapur ‘Dahanu and Umbargaon Ranges and must await the definite ‘settlement of the forests of those talukas While there are about ‘400 coupes in Mokhada which cannot be marked out until the ‘organization of these forests has received further consideration

‘ Besides this work in Thana the whole of the working plan of ‘the Godhra Range in the Panch Mahals Division was marked on the ground This work represents the laying out of 541 ‘coupes in 18 blocks containing in all 88 145 acres This work was ‘rendered difficult by the almost total absence of stones available ‘for cairn building so that mounds of earth had to be substituted ‘These earth mounds were an experiment, and if they are found not ‘for have withstood the present rains, some more lasting mark will ‘have to be devised to replace them The work cost Rs 3-3 6 per 'coupe, or 3¾ pies, per acre which is most satisfactory and is no 'doubt due to the fact that the services of Mr Dodgson were 'availale for personal and continuous supervision."

Under the head "communications and buildings," Rs. 7,275 were spent by the Department and Rs 2,099 by the Public Works The money was mostly spent on repairs to forest buildings and the like

Under "general protection' the Conservator hopes that the proposed increase of establishment will allow of efficient protection No doubt, but a radical change in the forest policy of the Bombay Government is necessary before any noticeable improvement can be expected.

The cases tried by Magistrates were 209 as against 230 last year The acquittals were 50 against 94, making a percentage of 19 3 against 29 01 With the exception of 57, the cases were all for thefts, mostly of timber

In 1,295 cases the offenders could not be found, and this is the important point of the whole matter for it shows that the Department receives no support The figures include the whole of the (recorded) forest fires, to the number of 624, together with 536 thefts of timber, &c The previous year only showed 1,080 such cases

In the case of lands notified under section 4 of the Forest Act, 42 offences were committed It appears that the only method of punishing offences in such lands lies in section 43 of the Land Revenue Code The fact that all the cases were convicted and punished to the tune of Rs 481 shows that the Forest Officers have reason to be grateful to their Revenue colleagues for efficient support, and perhaps also that the Revenue law is more willingly made to be respected than the Forest law. There were only 25 such cases the year previous There were 331 cases taken into Court, as against 373 the previous year, and of these 75 remained undecided at the close of the year Rs 2,008 were taken in the 404 cases compounded, being 47 cases fewer than last year

Fire protection is admittedly somewhat of a farce, as can only be expected as long as Government refuses to enforce responsibility on the privileged classes to whom practically the whole of the fires are due

The fire protected area was 1,022,783 acres, against 1,021,391 the previous year The area burnt is put at 1[illegible]4,563 against 66,839 or 61 5 against 53 8 per cent This in spite of special efforts for protection The Conservator claims no improvement in protection but increased accuracy of reporting, for which there was, and no doubt still is, ample room Some years ago, practically the whole district was burnt, twice in those places where it was possible. It is probable that things are still in almost the same state, since the only remedy lies in the guard first catching his incendiary and then securing his conviction, two remarkably difficult tasks in these days of sharp vakils, and sympathy with forest offenders The number of fires reported in East Thana was 286, of which only 21 entered from outside These 21 fires covered 2,523 acres In view of the fact that the Department cleared fully ten times that area in fire lines, the Conservator naturally enquires whether the trouble and cost are justified This is an open question, for no doubt a few fires may have been stopped by fire lines, though the people generally look to that carefully and the internal lines may have arrested some Of the remaining fires, 197 originated in open forest, and 68 in blocks supposed to be closed, four incendiaries were caught and the cases are pending, one was compounded, being perhaps accidental and one, the useful child-offender, was let off In West Thana a system of patrols was partly substituted for fire lines of which only 5,000 acres were burnt, against the usual 30,000 with satisfactory results There were 202 fires reported against 106 the year previous, mostly arising inside the forest as per usual custom The incendiaries were traced in 6 cases The Conservator much against his will is becoming convinced that the only possible means of combatting a communal evil is by enforcing communal responsibility

"All this may produce the desired results but I fear that nothing will really succeed but the enforcing of communal responsibility in exchange for the communal privileges which render the 'Forest Department powerless in this matter of preventing forest 'fires I still however hope for the best for I shrink from asking 'for the withdrawal of these privileges—a course which would 'necessitate special arrangements for enforcing the prohibition in 'the nature of punitive posts'

In Surat the question is equally unsatisfactory the whole Dangs were burnt probably twice over on the chance of driving out a hare or a peafowl for the greater part In Mandvi 40 fires were reported, against 60 the previous year, the area burnt being put at 25 per cent less If the improvement is truly stated, it must be largely due to the exertions of Mr Wood, I C S, who is engaged on the forest settlement, and has previously distinguished himself by the thorough manner in which he has endeavoured to assist the Department in this matter

The Panch Mahals figures are of little use since they show that 2 per cent of the protected area was burnt, against 18 per cent of the unprotected area this year and 18 per cent of the total previously These curious figures are explained by the fact that part of the unprotected area is scarcely liable to fires while for the balance the returns are utterly unreliable

Three fires, covering 1 800 acres, it had not been thought worth to report at all No more was it, if proceedings were to end in the filling up of three or four tabular statements Three incendiary cases were punished, one in Godhra got 3 months' rigorous, hile in Halol, 4 men were fined Rs 4 each, and 4 others were fined Rs. 15 each. Rs 4 seems very small, but it was quite possibly sufficient, and there is no good inflicting crushing punishments where the intent was not evil. The one case that really ought to have been made an example of escaped, no doubt because of our much-law-and-little-justice system. The Thakur of Bhamaria was prosecuted for firing the jungle while shikaring, and for refusing to give assistance. The offence could not be brought sufficiently home to him (it never can in the case of a big man with servants) and he was fined Rs. 200 for trespass, which was remitted on appeal.

The grazing regulations made some years ago are not yet in force in the Northern Circle, except in Surat, and the Panch Mahals and two Ranges of Thana. The cattle impounded are put down at 7,852, against 10,539 the preceding year. It is not improbable that anyone possessed of a reliable flying machine might count this number of cattle trespassing in closed blocks every day, unless a vast improvement has taken place in the powers and respect accorded to the Department.

Natural reproduction is stated to be generally good so far as coppice shoots are concerned, but that seedlings seldom survive the first fire (*i. e* that there are *practically none in the district)*

Artificial reproduction is confined to the felled coupes In West Thana, Xylia dolabriformis has been sown on hill tops.

" A comparative statement of timber and firewood exploited 'departmentally from the forests for the two years offers the fol'lowing difference :—

'No.	Division.	Year.	In Cubic feet.	
			Timber.	Firewood.
'1	East Thana ...	1894-95 ...	1,035	450
		1895-96 ...	2,667	2,993
'2	West Thana ...	1894-95 ...	686	*Nil.*
		1895-96 ...	7,818	34,150
'3	Surat	1894-95 ...	37,629	2,796
		1895-96 ..	46,109	826
'4	Panch Mahals ..	1894-95 ...	80,610	2,06,525
		1895-96 ..	44,861	1,04,480
	Total ...	1894-96 ...	1,19,960	2,09,771
		1895-96 ...	1,01,455	1,42,449

'In the Thana Division, as last year, it was not found necessary to undertake any departmental fellings of coupes, and the figures 'given represent the material derived from trees blown down by 'wind in forests which had to be removed departmentally.

'In Surat, the increase is due to a number of dead teak trees 'collected departmentally in the Mandvi Range.

'In the Panch Mahals, material was derived from—

'(*a*) Cuttings made to meet the wants of poor agriculturists.

'(*b*) Cuttings made on the boundary lines.

'(*c*) Cuttings made in clearing fire-lines."

"In the Panch Mahals Division, a system of agricultural depôts 'was introduced last year on the demand of the Collector. It was 'not very successful and I wished not to continue it, but the Collec'tor asked for a further trial. There was some delay in arranging 'for the distribution of the wood which is consequently shown as 'balance in hand at the close of the year."

Agricultural depôts have always been a pet scheme of the civilians, and have always been pre-doomed to failure. It is curious how any man can expect natives to trudge to a depôt, so long as they can take what they want for nothing, or if they are caught, on payment of not more than the value of the produce. ("*in no case shall the compensation exceed the value of the produce*" Bombay Government Orders.) The guard will probably not run them in, he knows too well what *too much zeal* means, and prefers a safe two annas to a wigging for "oppression", and probably a false charge brought against him.

"The exploitation of major produce by contractors under the coupe system in the Thana Divisions compared with that of 1894-95 was as follows :—

'No.	Division.	COUPES EXPLOITED.							
		1894-95.				1895-96.			
		Number.	Area.	Receipts.	Average price per Acre.	Number.	Area.	Receipts.	Average price per Acre.
				Rs.				Rs.	
'1	East Thana .	134	7,356	1,93,097	26 1	122	6,378	1,95,281	30·6
'2	West Thana ..	121	6,501	3,19,947	49·2	118	6,579	2.76.378	42·
	Total .	255	13,857	5,12.744	37·	240	12,952	4,71,659	36 4

"In the East Thana Divisions 145 coupes were marked out for 'sale ; of these, 114 only found purchasers, leaving 31 unsold. Of 'these 31 coupes, 8 were in Mokhada and 6 each in Vada and

'Khardi Ranges in forests abutting on Mokhada This is a very 'wooded country and is, moreover, very difficult of access. There 'is no demand for rab from the coupes, and it is for consideration 'whether the system of working them should not be changed to one 'which would aim at the production of large timber, the conditions 'which necessitated the short revolution and small blocks adopted 'in the rest of Thana being absent '

" The Commissioner thinks this point well worthy of consideration It was obviously unnecessary to cut up the whole of any Division, let alone two whole circles, into blocks averaging 2 000 acres each, with an annual coupe in each

"In West Thana Division 131 coupes were laid out for exploitation during the year , of these 112 were sold, leaving 19 uncut. 'These were either too difficult to work or carried too little wood to 'be worth working '

'The coupe system has now been nearly 10 years in force and 'contractors are beginning to look round for means outside their 'contracts for increasing their profits I regret to say the almost 'unanimous tendency is to seek this 'extra' profit by the theft 'of reserves This is of course a serious matter jeopardizing as it 'does the future of the coupe It is satisfactory, therefore, to be 'able to record that in most cases the fraud was promptly discovered 'and dealt with In East Thana where a contractor had felled 40 'reserved trees worth about Rs 400 marking in their place 40 other 'comparatively worthless trees, it was found impossible to bring the 'theft home to him criminally His contract however, was 'suspended and he was only allowed to resume work after payment 'of Rs 1 000 In West Thana, in a somewhat similar case, the 'contractor was criminally prosecuted but committed suicide, before the case was tried It was discovered that he was hopelessly 'bankrupt "

"The reserves at present are marked with a ring of tar, which 'is of course easy to counterfeit , but it is hoped that with an 'increased establishment it will be found possible to mark all 'reserved trees with a special timber stamp'

" The gross yield of the coupes worked is estimated by the 'Divisional Forest Officers as follows —"

	TIMBER, C FT		Firewood and Charcoal c.ft
	Teak	Junglewood	
'East Thana	927,016	225,440	3,923,865
'West Thana	1,297,170	308,250	4,847,900
Total 1895 96	2 224,186	533,690	8,771,765
,, 1894 95	2,648,977	1,091,113	4,538,266

This is an average of 171 c ft. per acre, as compared with 192 last year. Apparently a great deal now classed as firewood was entered as junglewood last year. It is not stated whether contractors have any interest one way or the other. The Conservator hopes to have more reliable figures next year, not only for the outturn, but also for the reserves. The reservation form in Thana used to give the species and girth of each tree reserved, and whether it was a good or bad tree. That ought to suffice for the present, and any spare time would be occupied much more usefully in verifying a percentage of the coupes every year, than in recording heights, volumes or other less needful information. There used to be a lot of looting of reserves in coupes 3 or 4 years old, and probably still is.

Besides the above outturn, some 20,000 teak royalty trees were sold off occupied lands, the contents being unknown. The practice of reserving for the free use of the villagers all wood less than 6″ girth in the coupes still continues, and can hardly be expressed in figures. It is also impossible to estimate the amount of dead wood removed for home consumption or for sale by the wild tribes. This privilege alone is sufficient to keep the forests in a constant state of conflagration, in order to keep up the supply. So long as the supply keeps up, it cannot be expected that the wild tribes will take to regular work

In Surat the yield is mostly removed by purchasers, as follows

		Timber		*Firewood*
		C. Ft.		C. Ft
1894-95	...	47,755	...	19.384
1895-96	...	106,466	...	76,085

Also 1865 teak royalty trees standing on occupied land were sold at Re 1 each, and 114 others at various prices.

In the Panch Mahals the outturn was almost entirely from Government lands outside forest lands, which probably ought to be inside, for the Panch Mahals Forest Settlement is less satisfactory than it might have been. In the hurry of the Revenue Department to denude these lands, the outturn has been largely increased as follows :—

		Timber		*Firewood*
1894-95	...	130,671	...	141,828
1895-96	...	421,862	...	120,512

The number of Bamboos removed was much the same as last year except that there were nearly 3,000 more headloads. The number removed under count was Rs. 1,805,478, plus 5,746 cartloads and 6,712 headloads, for Rs. 34,463, or Rs. 4,000 more than last year.

The Conservator says :—

“ There was no change in the system of working except in the Dangs. There the open permit system was found to have been working unsatisfactorily. In order to save trouble in extracting ripe bamboos from the centre of the clumps, much damage was 'done to the immature culms on the outside and it was impossible 'to fix the responsibility. Accordingly during the year under 'report, the area to be worked was roughly divided into 10 blocks 'and the right to remove 50,000 bamboos from each of the blocks 'was sold to a contractor. The plan is reported to have worked 'satisfactorily," but it is not explained what induced the contractors to be more considerate simply on account of the division into Blocks. The presumption suggested is that there were 50,000 ripe bamboos always on the outside of the clumps, an arrangement much more neat than probable.

Minor produce gave Rs 9,460, but nearly everything is, or used to be, given away.

Free grants amounted to Rs 4,555

The financial results of the year compared with last year are as follows :—

Year	Receipts	Expenditure.		Total	Surplus.
		A	B		
	Rs	Rs	Rs	Rs.	Rs.
1894-95 ...	7,38,689	96,961	1,78,971	2,75,932	4,62,748
1895-96 ...	7,83,283	1,08,221	1,89,216	2,97 437	4,85,846
Increase ...	44,603	11,260	10,245	21,505	23,098

The increase under B is due to the creation of a Conservatorship in place of Sind abolished (there is still another seriously needed) and to the arrival of a new officer from Coopers Hill

The following remarks of a Conservator tend to show that the Upper Dangs forests require a rest, but really what is required is rest and effective protection for the whole Dangs.

" I regret to have to record from a financial point of view that the above-ghat purchasers still refuse to take wood on the conditions introduced last year. The export from the Upper Dangs amounted to only a paltry 50 khandis. I have, however, visited this part of the Dangs and I confess that no harm is being done by giving these forests a rest The small amount of timber which was brought out was of pitifully small scantling and it will, I think, be in the truest interest of Government to discourage this above-ghat export until improved communications admit of the removal of full grown logs. I understand that very extensive clearings of teak from occupied lands in Peint have been and are going on ; no doubt this counts for much in the reduced demand 'on the Upper Dangs and in the interests on the Upper Dang 'forests, I trust that no further demand will have to be made on 'them for several years I must record, however, that some 'Gujarat contractors removed 500 khandis of *dead* teak from the 'Upper Dangs, as this is a new departure

In the following statement the financial results of the Northern Circle for the past 10 years are given :—

Year	Receipts	Expenditure.			Net Revenue.
		A.	B	Total.	
	Rs.	Rs	Rs	Rs	Rs
1885-86 .	5 25,484	76,742	1 42 953	2,09,695	3,15,789
1886 87 ...	4,43,157	89,724	1,44,507	2,34,231	2,08,926
1887-88 ...	4,73,104	85 645	1,45,407	2,31,052	2,42,052
1888-89 ...	5,78,425	88,924	1 47 364	2 36,288	3,42,137
1889-90	5 96,066	93 419	1,45,341	2,38,760	3 57,306
1890-91 .	6,37,408	1,04 809	1,39,880	2,44,689	3,92,719
1891-92 ...	6,14,270	93,399	1 30,089	2,23,488	3,90,782
1892-93	6 82,884	1,38 639	1,96,486	3,35,125	3,47,759
1893-94 . .	7,60,953	98,047	1,66 899	2,64 946	4,96,007
1694-95 ..	7 38 680	96 961	1,78,971	2,75,932	4,62,748
1895-96 ..	78,3,283	1,08,221	1 89,216	2,97 437	4,85,746

The casualties were rather heavy A sherastedar, a peon, and 12 guards, died of fever, 11 guards resigned, 5 were degraded, and 22 were dismissed either for overstaying leave (frequently from dislike of the work and constant sickness) or misconduct.

The views of the Commissioner in forwarding the Report, though they give little hope of anything effectual being done, may be quoted.

'MR. LELY says —" As to the co-operation of the people, an 'obvious course is to make them see that their privileges depend 'upon their giving it; but this should be done very cautiously and 'with the full consciousness that it will take many years for a forest 'policy to strike root in the sense of the people They have been 'brought up to regard the forest as the property of every person 'who may wander in it, and to view with unconcern the destruction 'of valuable timber for the sake of a crop of cheap grain. They 'must be taught differently by steady pressure, always remembering 'that popular ideas cannot be changed in a year or even in twenty '—unless indeed, by enforcing drastic measures, such as would not 'in this age be thought of."

"Mr Wroughton, in some forcible remarks made in paragraph '41 of his Report for 1894 95, objects to the system of reporting 'fires by post card to the Assistant Collector as worse than useless. 'The Commissioner does not agree with this , for, he would regard 'every important forest fire as a serious matter to be reported as 'such to the Magistrate in charge of the taluka It should be 'made the subject of a special inquiry, the result of which should be 'laid before him , and, if a village is morally found to be at all in 'fault, some slight, but emphatic, mark of the displeasure of 'Government should be inflicted It is absolutely necessary, at the 'same time, that the third method should be more developed ; and 'that the number of well-paid and well-supervised guards should be 'increased Poorly paid or badly-supervised they will only make 'matters worse Meanwhile, it is hoped, the Divisional Forest 'Officers will not relax their efforts to ensure correct reporting "

CENTRAL CIRCLE —The area was increased by about 32 square miles, bringing the total up to 6,350 square miles and 35 acres, over 17 square miles being merely due to rectifications of erroneous figures Forest settlement is practically completed with the exception of numerous little patches of cultivation which honeycomb the forests and must be acquired by purchase or otherwise before their situation can be considered satisfactory The scattered settlement work done during the year cost Rs 8 083 The creation of new and up keep of parts of the old boundaries, 669 miles and 13,093 marks cost Rs 6 420 It is required in Bombay that the line must be clear and visible from mark to mark, so that no person can cross it without knowing he has done so The Forest Survey Branch carried out work on the 16 in , 8 in , and 4 in scales to the amount of Rs 22 380, the cost per square mile being respectively Rs 130, Rs 94 and Rs 62 The total area surveyed to date amounts to 1,267 square miles

The Working Plans branch demarcated 177 compartments at a cost of Rs 773 covering nearly 15,000 acres About 1,600 marks and 16 000 small stones were erected, besides 338 ditches dug and 493 old cairns repaired Besides this the Divisional Officer had 94 compartments demarcated A number of provisional working plans were prepared, mostly in E Khandesh, Nasik, Ahmednagar and Poona As in the Northern Circle, the whole of these working plans follow the stereotyped lines of 40 compartments in coppice with standards A total of 2,440 square miles has been brought under these plans to date, but only a few of the 40 compartments in each block have as yet been laid out, so that they exist at present mainly on paper The Deputy Conservator in charge (the Hon Mr Shuttleworth, being on special Famine work) considers this quite as it should be, principally on grounds of finance, but he rightly points out that the making of Working Plans for forests that are not yet properly mapped, is very like putting the cart before the horse. In fact it is to be hoped that this wholesale Revenue Department scheme of 40 coupes, here as in the Northern Circle, may not be finally allowed to override all considerations of good forestry.

Two ghat roads, principally for timber traffic, in the Khandesh and Nasik ghats are under survey. Another was sanctioned but not begun, and the usual repairs were made good. It is difficult to make out the precise expenditure under this head but it appears to have been about Rs. 6,000. Another Rs. 60,000 were spent during the last few years, probably by the P. W. D., on two roads in Ahmednagar. On buildings about Rs. 10,000 appear to have been spent either by the P. W. D. or at the charge of the Forest Department.

" At the opening of the year 256 prosecutions before Magis- ‘ trates, and 8 cases under disposal by Forest Officers in the purview ‘ of Section 67 of the Forest Act were in hand ; 15,083 cases of ‘ breaches of Forest law were discovered during the year; and in ‘ 1,436 of these cases the offender was not found ; 2,063 cases were ‘ considered under Section 67 of the Forest Act by Forest Officers. ‘ 1,723 cases were sent up for trial by Magistrates ; and ‘ 9,861 cases were let off by Forest Officers who warned the ‘ accused persons and relieved them of further proceedings under ‘ the Forest Act. The number of old and new cases under hearing ‘ during the year amounted to 1,979 against 1,972 of the preced- ‘ ing year ; of these, 1,799 were completed, in 1,466 of which con- ‘ victions were given ; 333 were acquitted and 180 were left pend- ‘ ing at the close of the year. In the 1,466 cases of convictions by ‘ Magistrates, 3,799 persons were sentenced to fines or terms of ‘ imprisonment or both, and 976 accused persons were acquitted, in ‘ the 333 cases which were dismissed by the Magistrates. Of the ‘ 2,071 cases, including 8 of the previous year considered under ‘ Section 67 of the Indian Forest Act by the Divisional Forest ‘ Officers, 2,056 were disposed of, leaving 15 unfinished. 5,755 ‘ persons were involved in the 2,056 cases disposed of under Sec- ‘ tion 67 of the Forest Act."

The Conservator thinks that 15,000 cases are not too many for 6,350 square miles, large areas of which are wild country, to say nothing of the undiscovered cases, which may be as numerous as the warnings. Ahmednagar has roughly, 4 reported cases per square mile, Satara a little more, Poona has about 5½ and Sholapur over 7. But then the Conservator is getting used to it. Government has laid it down that "leniency * * is proper in the ‘ case of first offences and petty and isolated pilfering for personal ‘ use. It may also be proper when restrictions necessitating sudden ‘ changes in the daily habits of the people have been recently intro- ‘ duced and imperfectly understood. But leniency is misplaced ‘ and destroys the deterrent effect when forest depredations, how- ‘ ever trivial they may appear when considered as individual and ‘ isolated acts, have become in any locality, in spite of repeated ‘ warning, systematic and persistant." The Divisional Officer, Poona, coming new to the District, takes a very unfavourable view, and complains of the prevailing disposition of the Magistracy to treat forest offences leniently, remarking "the chief class of offence is 'cattle grazing and obstruction to pounding with more or less violence, and must remain so till the Subordinate Magistrates give 'deterrent punishments, in fact the remark applies generally to all classes of offences, and it is only when the villagers rise 'en masse and cut teak wholesale that any serious notice is taken 'of offences '

In Ahmednagar 331 cases were convicted, but in no single case was imprisonment awarded Such leniency simply tends to the increase of forest offences The Collector would be amusing, were the matter less serious He says "The frequency of forest 'fires in spite of the fact that the forests are in small patches and so 'protected from great conflagration, the numerous thefts of forest 'produce, amounting in some cases to wholesale depredations of 'timber, the evident complicity of villagers and village officers in 'both thefts and fires All these things are primarily due to the 'neglect of the forest Subordinates from the Rangers downwards 'But they also afford evidence of a want of respect for Government 'property in land quite peculiar as far as the Collector's experience 'goes to the district of Poona"

Poor Forest Department it was doing its work fairly well under great difficulties until a regular crusade was organized against it and it will be many a long year ere it gets over the soreness and demoralization caused thereby

'Last year 1,453 new cases were registered under Section 67 'of the Forest Act, and 2,063 new cases in 1895-96 thus there has 'been an increase of 610 cases this year, on the other hand 1,458 'cases, old and new, were disposed of in 1894-95, and 2 056 have 'been disposed of this year—an increase of 598 '

'The number of cases disposed of under Section 67 of the 'Forest Act was 2,056 against 1 458 of the previous year, and the 'compensation accepted for the offences amounted to Rs 6,602 as 'against Rs 5,041 in 1894-95"

'New rules have been introduced under Government Resolution No 4516, dated 15th June, 1895, as amended by Government 'Resolution No 6102 dated 10th August, 1895 for the report and 'treatment of forest offences to and by Forest Officers, which direct 'that no order shall be given to proceed under Section 67 in any 'case in which the Divisional Forest Officer would not be prepared 'to order Magisterial proceedings to be taken.

'This is not in accord with the Forest Act, which requires not 'Magisterial proof, but only '*reasonable suspicion.*"

"The following statement shows the classification of the sums 'of money accepted by the Divisional Forest Officers under Section 67 —"

Division.	Number of cases in which compensation was fixed at Rs.											
	Re. 1 and under.	Rs. 2	" 3	" 4	" 5	" 6	" 7	" 8	" 9	" 10	11 to 50 Rs.	Total.
East Khandesh	138	30	17	5	6	7	..	8	2	3	8	217
West Khandesh	151	40	22	9	8	5	8	8	2	8	10	261
Nasik ..	109	68	29	7	16	16	2	8	8	4	6	263
Ahmednagar	15	17	8	5	1	1	.	2	..	1	4	54
Poona ..	125	80	58	42	52	22	27	23	9	16	79	542
Satara ..	20	24	15	4	11	8	1	3	2	4	11	103
Sholapur ..	280	128	66	44	24	17	16	5	12	5	19	616
Total .	833	306	215	116	118	76	40	47	30	36	137	2,056

In cases convicted in court, the payment of a roward is obligatory, and forest subordinates received Rs. 4,472 on this account. The rules under Section 75 of the Forest Act allow of a reward in cases compounded, but only two Divisional Officers, those of Poona and Satara, ventured to give it effect. The Conservator recommends that the reward should be obligatory in all cases, and he is no doubt in the right. It may be recollected that at the time of the anti-forest crusade, no invective was too bitter to use against those who had been extorting fines and dividing them among their subordinates, as it was expressed with more picturesque effect than truth to nature. Of course the wind was knocked out of this accusation, by forest officers pointing out that what was right in a court of law could hardly be wrong in compensated cases, that the fines were *not* "divided," but rewards paid out of a separate fund, and that finally the practice, exactly as carried out, was formally authorised by Government in a set of rules only three or four years old.

Nearly 10,000 cases were let off with a warning, on the grounds that the offences were trivial, committed through ignorance, by minors, or by persons who were not known to have offended before. No less than 71 of these were fire cases by children whose parents ought to have been made to suffer. The whole reason of the objection to have a competent herdsmen in charge of village cattle in forests, lies in the fact that they intend to commit offences, and do not intend to have anyone suffer for them. Government consents to this after admitting in principle the evil of doing so. Another piece of "tyranny" was what was called "punishing the same offence twice." This awful crime consisted in sending trespassing cattle to the pound and in making the owners pay compensation under Section 67 for damage done in the forest, exactly as laid down in the Act. It is not stated whether there is still a rule that no pounded cattle are to pay compensation, but Government had to admit that the scale of fines, without compensation, was absolutely ineffective, and so raised them considerably.

In protection from fire the Central Circle is far superior to the Northern, because the cattle let off with a warning leave very little to burn ; partly also because the rainfall is deficient over much of the area.

" The results of fire conservancy, compared with those of the ' year preceding, are tabulated below :—"

' Division.	Forest area placed under protection against fire in Acres.		Failures.		Percentage burnt.		Expenditure incurred in Rupees.	
	1894-95.	1895-96.	1894-95.	1895-96.	1894-95.	1895-96	1894-95.	1895-96.
	Acres.	Acres.	Acres.	Acres.			Rs.	Rs.
' East Khandesh ..	519,145	519,104	44,544	45,999	8·5	8·5	93	144
' West Khandesh	1,103,958	1,111,451	138,981	211,721	12·5	12 5	769	568
' Nasik ..	818,975	818,805	8,119	18,279	0·9	2·2	216	198
' Ahmednagar ..	542,895	542,997	2,445	3,172	0·4	0·5	..	17
' Poona ..	457,025	455,444	7,239	21,166	1·5	4·6	921	6
' Satara ..	432,034	446,691	3,635	1,653	0·8	0·3	37	40
' Sholapur ..	177,910	177,752	413	853	0·2	0·4	.	1
Total ..	4,051,937	4,072,244	205,376	302,843	5·0	7 4	2,036	974

The year having been a dry one, fires ran through 7 per cent of the protected area against 5·0 per cent the year before, but there is no doubt that the area here as elsewhere is greatly underestimated. A new reason is given for the heavy incendiarism in Poona, namely that the cattle may not be tempted to stray into closed areas when the season for letting them loose arrives. Anything in short rather than the competent herdsman whom Government once ordered but refused to enforce. In Eastern Khandesh some right (? concession) holders were prosecuted and punished for refusing to lend assistance, but the penalty is not stated separately ; it ought to have been exemplary. In Western Khandesh, the Divisional Forest Officer thinks that the real area burnt was 2¼ lakhs. In Nasik, villagers having caused a 4-5 days fire and been negligent in extinguishing it, their privilege of collecting Mohwa flowers and grass was stopped, but it is not stated how or whether the stoppage was anything more than theoretical. The Collector's idea of stopping fires appears to be to order the Police to be on the alert, and to order the Divisional Forest Officer to put on extra watchmen and patrols, and make them personally responsible for tracing offenders. The most necessary and only practical step, that of making the villagers pay the extra cost, was assuredly not taken. In Satara a punitive post was quartered on 10 bad villages with excellent results

From the return of cases of forest fires prosecuted it appears that the punishments inflicted, with one exception, were distinctly of the nature of warnings rather than punishments.

The grazing rules of 1890 still hold good. It would be interesting if these rules were added as an appendix to the Report, with a statement as to which of them are enforced and which not. This kind of information ought not be omitted, as it is one of the most important branches of the forest management. The closed area was ·28 of the total.

The total number of animals impounded was 321,994, of which 196,661 head were from closed forests. In the East Khandesh Division there has been a considerable increase in the total number of animals impounded, especially in open forest, owing to the dilatoriness of village officers in issuing grazing permits and to the propensity of the village cattle-owners to drive their cattle into the forests without having taken out permits in the hope that they may escape detection The large numbers of sheep and goats in the Deccan are responsible to a great extent for the high figures in this circle. Some 50,000 acres were temporarily opened on account of short rainfall. There are complaints that the lax treatment of offences by Subordinate Magistrates has a demoralizing effect on the forest guards, which is only to be expected. The villagers impound each other's cattle more than the Department does, and in a shorter season. This year they impounded 531,801. One Collector remarks that the very liberal area open to grazing "accounts in great measure for the poor appearance the forests present."

There have been various attempts to open the forests to sheep and goats, which have so far been defeated. There appears also to have been an attempt made to transfer the management of Deccan forests to village and revenue agency while still recording them as "forest." This would mean practical disforestment, and would assuredly end in their ruin, not only as source of fuel, but even as grazing lands. This is another matter of extreme importance to the country, which is not ventilated as it ought to be.

"Village officers give very little assistance in working the
'grazing rules : they are the agents for issuing grazing permits to
'to the owners of cattle in forest villages, and the grazing permits
'should all be issued before the grazing season opens. But they
'avoid this work although they are paid by the Forest Budget 7½
'per cent. commission on the grazing fees collected by them and
'credited to forests by means of grazing permits issued by them to
'village cattle-owners. It pays them better to see the village cattle
'impounded for illicitly grazing, for then they get 25 per cent. on
'the amount of pound-fees recovered by them and credited to Local
'Funds ; and there is the further prospect of grazing permits being
'issued later on and the commission on grazing fees swelling the

'commission on pound-fees for the same cattle The village servant 'or officer makes no attempt to protect closed forest or to assist 'in the regulation of the grazing of village cattle Ask the Pátil 'the Kulkarni, the Jáglya, the village Mahár or other menial ser'vant in the village the number of impoundings he has made from 'closed forests and the invariable reply will be—' None" And 'then go into closed forests and cattle will be seen grazing with or 'without care-takers, with no permits, and it will be found that a 'large proportion of the cattle belongs to the more wealthy inhabi'tants of the village—to the Patil, to the Kulkarni or their kith and 'kin This is the agency to which it has been fatuously suggested 'to entrust the management of forest grazing lands in order that 'cattle impoundings may decrease"

"The grazing statistics of a group of 41 villages in the Central 'Circle illustrate forcibly the truth of what has been written above 'In these 41 villages the area of open forests available for grazing 'is 12,832⅜ acres their grazing capability 24 603 head of cattle 'there are 4 013 privileged cattle given free grazing in these villages 'So that 20,590 cattle can graze on payment of a fee not exceeding '4 annas per head of bullock or cow for the whole of the grazing 'season of about 8 months Up to the end of September grazing 'permits on payment of fees of the value of Rs 380-12-0 for 662 'cattle only had been issued , but out of this amount Rs 297 are 'for grazing permits issued by the Range Forest Officer to owners 'of outside cattle So that the village officers have issued grazing 'permits of the value of Rs 83-12-0 only for village cattle and in 'but 7 villages out of the 41 have any fees grazing permits been 'issued at all by village officers for village cattle So that on the '1st October there was grazing still offering in the open forest for '19,917 head of village cattle to be admitted on permits The 'Forest Officers are forbidden to issue grazing permits to village 'cattle and their duty is to protect the grazing by impounding 'trespassing cattle '

The feebleness of forest protection is again exemplified in E Khandesh where some villagers broke down dense thorn fences and ruined the regeneration The collector graciously permitted the Department to put up wire fencing instead, at its own cost It is a maxim of law that no man is expected to fence against his neighbour's cattle If the Revenue Department insists on our fencing, the cost ought at least not to be added to the other heavy items incurred for the pleasure of that Department making forest administration appear so expensive that no improvement can be afforded

Natural reproduction is stated to have been good, where not ruined by fires or cattle The forests in the west of Poona are stated to be "now fully stocked ' This must have been written with only one or two below-ghat villages in mind for unless some unlikely miracle has occurred the statement cannot be within 50 per cent of the fact, or even half that, "The former "*gairan* 'lands included in reserved forest in the Maval range where 'villagers have the privilege of cutting all but 22 species for rab 'are practically shaven and shorn of all ligneous growth"

In the eastern parts of Poona regeneration is "quite checkmated" while in the teak zone the effect of fires on the splendid regrowth in the old coupes is 'simply heartrending"

A great deal of artificial regeneration was done by both planting and sowing, in E Khandesh 5301 acres, in Ahmednagar over 10 000 acres, Poona about 9,000 in Satara 21,000 or more, in Sholapur 198, and other Divisions which show only the amount of seed used The results do not seen to be much better than hitherto and not infrequently the people purposely breach the fences without being taught better by the Magistrates

The major exploitations are by clear fellings, by area in babul and kheir forests, or as a temporary measure, clear fellings of royalty teak high forest or isolated trees in occupied lands, so as to get rid of royal rights outside forests In the Peint range of Nasik over 122 000 such trees were sold at a shade over 8 annas per tree The leaf manure off them would be worth more The selection fellings so called were not made under the selection or any other system but simply to supply a demand The coppice fellings of course, being under a sanctioned working plan, are regular, but the "improvement fellings" again seem to be simply supplying a demand without much guarantee of improvement But this part of the report is a minor detail in comparison with the crying exigencies of protection Only when protection is real will it be really worth while to take sylviculture very seriously.

The "*gairan*" lands included in Reserves are all ruined and bare or soon will be These lands are jungle survey numbers opposite to which the survey records had in the "remarks" column something to the effect that the land was used, or merely suitable for grazing The remark appears to have been uncalled for by any order quite haphazard, and not in the least an admission of grazing rights Nevertheless in view of the doubt, Government ordered that all such land, though now Reserved Forest, should be maintained open, or something to that effect, with the results recorded above

Grass was cut and removed from 277,247 acres, for a price Rs 55,503 received Some 12,000 acres, yielding 6,000 tons of of grass worth Rs 30,000 were as usual placed at the disposal of the commissariat and remount department The total number of cattle and other animals grazed in the forests was 1,489,019 compared with 1 369,344 in the previous year, and free grazing was given to 2,64,383 head as against 409 546 in 1894-95

This remarkable decrease, which occurred principally in the Satara Division is due to the laxity of the Revenue Department and its village officers as already explained the figures are obviously incorrect The receipts from grass and grazing amount to over Rs. 4 lakhs.

Minor produce, notwithstanding popular privileges, brings in a little, contractors being allowed to remove what they can without curtailing local supply. Hirdas of course are reserved, the crop was large but prices poor and most remained unsold, only about Rs 2,000 being realized against Rs. 16,000 last year, the price per Khandi of 1920 lbs having gone down from Rs. 67 to Rs. 27. The collecting itself cost Rs. 11,705. Oil brought in Rs. . 6,425 in W. Khandesh and a less amount in E. Khandesh. Cigarette leaves in Nasik gave Rs. 1,666. Acacia concima pods gave Rs. 3,000 in Satara. Some of these figures however do not agree with those given on p. 44 of the report.

The timber yield cut by the Department was 243,736 c. ft, against 314,694 last year, the firewood was 20,57,295 c. ft, against 21,10,643 c. ft. Purchasers removed 19,20,949 c ft of timber against 18,29,121 last year, and 2,002,829 c. ft. of firewood against 17,84,247 c. ft. last year. It is not stated whether the c. ft. were solid or stacked, presumably the latter, as there is no mention of a stacking factor.

The number of bamboos removed is put at 12½ lakhs for Rs. 15,728. Minor produce brought in Rs. 25,829, against Rs. 31,636.

It is impossible to record all the produce removed free or at reduced rates under the few rights and the immense concessions that exist. No attempt has been made in the Northern Circle unfortunately, but there is not the least doubt that these concessions cause a very important loss, both to Government in the Forest Department, and to *the rest of the tax-paying community*, both in the capital value of the forests and in the commercial value of the timber and other forest produce appropriated, for there is wide evidence to show that the forests are seriously injured in the exercise of forest privileges." The Divisional Forest Officer, Khandesh, reports that the privileges under the North Tapti Code spell ruin to the forests, especially Rule IX *e*, which allows living wood of the first quality to be cut by Bhils at the rate of Re. 1 per cart-load. This rule is the central plague spot of the North Tapti-Privilege Code. Timber of first quality includes bea (Pterocarpus), rohin (Soymida), siris (Albizzia), bondara (Lagerstrœmia), naktemoka, (Schreibera), dhaman (Grewia). Such excellent timber trees as bea (Ptreocarpus) and rohin (Soymida), the former only second to teak, have *disappeared out of the forests under this privilege over hundreds of square miles* of the Satpuda forests, and the other five kinds are also *going fast*. The Divisional Forest Officer has seen large bea (Pterocarpus) trees cut on the crest of the Satpudas where their commercial value is directly considerable and their indirect value as seed-producers alone is very great. The time for exorcising the permit system ought surely to have arrived in this enlightened age, when the value of forest conservancy is understoood by the civilized world as exercising a potential and vital influence upon the prosperity of a country and its people. The Bhil is no longer the Bhil of 40 years ago, and his subsistence on privileges pernicious to forest conservancy, can only tend to keep him away from agriculture and settled habits of industry "

The permit system in the Northern Circle has been doomed in theory any time since the last ten years, but the Collectors would never act up to their protestations Last year there was talk of stopping it finally Is it really stopped?

"The issue of free grazing permits for the last two years is compared below —"

No	Division	Animals		Value	
		1894 95	1895 9 9	1894 95.	1895 96
				Rs	Rs
1	East Khandesh	10 935	11,201	6,271	6,885
2	West Khandesh	25 407	26 185	13,813	14,065
3	Nasik	77,073	79,879	39,575	41,015
4	Ahmednagar	6 734	5,808	3,426	3,096
5	Poona	110 996	91,741	63,492	53,140
6	Satara	169,458	43,439	98,849	24,771
7	Sholapur ...	8,953	6,130	4,474	3,423
	Total	409,546	264,383	2,29,900	1,46,395

This table is a monument to the fact that sauce for the goose is not sauce for the gander There have been just as many cattle as ever in the forests, but the revenue officials have neither given them permits, nor allowed the forest Department to do so, nor even recorded them A tenth part of such laxity would suffice to send the whole Forest Department to jail, under the Bombay rules and disposition

The following statement gives an approximate estimate of the value of forest produce lost to the forest revenues by concessions in the several divisions;—

Division.	Timber.	Fire-wood.	Bamboos	Other minor produce.	Grazing and grass.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
East Khandesh ...	25	822	...	529	45,488	46,824
West Khandesh ...	1,082	.	...	900	50.226	52,208
Nasik	352	1,390	...	7,411	69,629	78,782
Ahmednagar ...	332	...	...	597	44,771	45,700
Poona	329	1,000	...	8,000	92,816	1,02,208
Satara	25	25,000	...	...	34,733	59,758
Sholapur ...	...	...	...	...	10,133	10,133
Total ...	2,208	28,212	...	17,437	3,47,756	3,95,613

If we assume the Northern Circle at 3 lakhs, the Southern at 2½ lakhs and Sind at ½ lakh, we get a total of Rs. 10 lakhs given away, and it is probably not overstated at that amount.

The revenue and expenditure for the past decade are given in the table below :—

Year.	Revenue.	Expenditure.	Surplus.	Remarks.
	Rs.	Rs.	Rs.	
1886-87	4,69,985	4,25,815	44,120	
1887-88	4,95,425	6,52,617	42,808	
1888-89	5,82,238	4,56,616	1,25,619	
1889-90	5,89,455	4,33,181	1,56,274	
1890-91	6,20,092	4,55,908	1,64,184	
1891-92	7,48,149	4,61,353	2,86,796	
1892-93	7,51,787	4,82,479	2,69,308	
1893-94	8,18,189	5,03,230	3,14 959	
1894-95	7,93.848	5,39.773	2.54,075	
1895-96	7,54,109	5,27.128	2,26.981	

VI.-EXTRACTS, NOTES AND QUERIES.

Proposed Improvements in British Forestry,

BY W. R. FISHER.

The climate of the British Isles is admirably adapted for the growth of trees for which a steady supply of moisture in the ground is the most important requisite. Nowhere in these islands is there an average annual rainfall short of 20 inches, that in the westerly parts of Ireland and great Britain sometimes exceeding 60 inches, and it is everywhere fairly well distributed throughout the year, occasional droughts prejudicial to tree growth being limited to the Eastern and South Eastern counties of England between March and July. The most recent drought we experienced was in 1893, when only 2 inches of rain fell at Coopers Hill, Surrey, during the four months March-June, whilst the average maximum temperature during each of those months was 8° Fah. above the monthly average. Even then an area of 20 acres planted out on the Bagshot sands with Scotch pine in February was a complete success, owing to the heavy February rainfall of 3 inches

The fact is that our woodlands suffer more from an excess of moisture in the soil, than from the soil becoming too dry, which is so often the case on the European continent This condition of swampiness in our woodlands is generally due to the fact that they are insufficiently stocked with trees, the natural drainers of the soil, and this fact is most clearly illustrated by the present condition of the Delamere Crown Forest in Cheshire. This forest of 5,000 acres of freehold lands has produced oak from time immemorial, but has been ruthlessly thinned out by the Woods & Forests Department and is now declared unsuited, owing to its swampiness, for its growth, and is being planted with Scotch pine. It was visited last year by the English Arboricultural Society, and in a note on its condition, printed in the proceedings of the Society it was cited as an example of "*how not to carry out forestry.*"

British winters are mild when compared with those of the continent, and are somewhat severe only in the Eastern counties of Great Britain, and the high northern moorlands. It is true that spring frosts are treacherous and may extend into June but provided that care is taken to shelter the more delicate species they offer no serious impediment to the growth of our indigenous trees, nor even of exotics, which like the larch, Weymouth and Austrian pines, Douglas and Silver firs, have proved to be useful constituents of our woodlands.

Strong westerly gales from the Atlantic ocean are the greatest natural obstacles against which British forests have to contend, and the deplorable ravages these gales occasionally effect were exhibited on a large scale in the Scotch Highlands, in 1893, when about 2,000,000 trees were blown down in the counties of Forfar and Perth That it is however within the resources of art to protect forests from storms, is admitted by the Scotch foresters, who visited the Hartz mountains in 1895 and those who may wish to study this subject fully should visit the Erzgebirge in Saxony, where they will see that even the shallow rooted spruce may be rendered almost wind-firm by suitable precautions British experience has proved that the Corsican pine, Norway maple, sycamore and some other species will resist the full force of the west wind and that a merely narrow belt of wind-firm trees is sufficient to protect, a wood behind it from damage by wind

As regards soil, a fair depth, which in the moist climate of Britain need not exceed four feet, and sufficient porosity are the most important conditions and forest trees will thrive on soils, which are too sandy or too stiff too shallow or too strong, for profitable agriculture Even in the case of fenland and bogs, which latter have certainly once been forest land, as the presence in them of bog timber, sometimes in large quantities, testifies, suitable conditions for the growth of trees may be secured after working out the peat and draining, the question of the possibility of economic forestry in such tracts being generally only one of expense All forest soil may be kept sufficiently rich in nutritive mineral and in nitrogenous matter provided the valuable humus supplied by their dead leaves and needles is allowed to accumulate and sufficient cover afforded by a dense leaf canopy so that the growth of weeds is prevented and moisture retained near the surface of the ground It is a matter for regret that these conditions are not always secured in British woodlands, there being too great a tendency to over-thin the trees, and in some of the beech woods, on the Chiltern hills, which from time immemorial, have supplied material for the important chair making industry, the dead beech leaves are removed for farm litter, and the soil, often a very shallow layer of loam above the flints and chalk, is consequently seriously deteriorating It being then admitted that our climate and soil are fully adequate for successful tree growth, the next question arises as to the areas available, and I have attempted to give some idea of these in the annexed maps, where the relative areas occupied in each county by woodlands and wastelands are shown by differently marked squares The following table gives these areas for great Britain and Ireland, taken from the agricultural returns issued respectively in 1894 and 1893.

	England acres	Wales acres	Scotland acres	Ireland acres	Total acres.
Field Crops and pasture	24 881,000	2 857 000	4,892,000	15,162,000	477,92,000
Mountain and heath land used for grazing	1,986 000	1 055 000	9 409 000	3 888,000	16,338,000
Woods plantations and nurseries	1 625 000	175 000	907 000	307,000	3,014,000
Surplus lands including road and inland water	4 052 000	687 000	4 45,000	1,349,000	10,333 000
Total Rs	32 544 000	4 774 000	19 453 000	20 716 000	77 477,000

In Vol 2 of the Manual of Forestry, 2nd edition, Dr Schlich assumes that of the surplus lands, 2 000,000 acres in Ireland, and 2 000 000 acres in Great Britain are available for planting and that a further area of 2 000 000 acres in the larger island may be found in the mountain and heath land at present used for grazing making altogether 6,000 000 acres capable of producing the 9,000 000 loads of timber we at present import annually This of course requires proof, but there can be no doubt that our actual 3 000 000 acres of woodland are at present only partially stocked and that by better management they can be made to produce a much larger quantity of timber than at present, and of much better quality, so that this paper will make no further reference to the important question of the afforestation of our wastelands but will simply deal with the possibilities of improvement in the management our actual woodland area.

That an enormous amount of planting is done annually in Britain will be at once recognized by any one who has seen the vast forest nurseries of Messrs Dickson at Chester where from an area of 450 acres, millions of young plants are distributed annually, or the large nurseries at Carlisle Leith Perth, and other places. Much of the energy expended in plantations is however wasted owing to bad choice of species for certain localities

The chief classes of forest met with in Britain are either coniferous high forest, sometimes but not nearly often enough, mixed with beech or with spanish chestnut in the north of England, beech selection forest as in the Chiltern hills, and coppice with standards Scotch pine and larch are the chief components of the coniferous forest and they are generally managed under the clear cutting system, the mature crop being felled and removed and the area then planted with a young crop. In the beech selection woods on the Chiltern hills, where only natural regeneration by seed prevails, owners have occasionally forgotten that beech trees will not produce fertile seed when less than 70 or 80 years old, and after having cut away all their mature trees, are surprised that natural regeneration has stopped The coppice with standards consists of an underwood of hornbeam, hazel, ash, sweet chestnut, alder, and other species, with standards chiefly of oak and ash.

Besides the above chief classes of British forest, osier beds and willow pollards and standards are grown along river banks, and pure coppice of oak for tanning bark, and of sweet chestnut for hop poles and alder for gunpowder and clogs are occasionally grown, whilst the cultivation of hedgerow trees, chiefly elms and oak, prevails to a larger extent than in any other European country Much has been written about the proper method to grow trees in all these systems, but example is better than precept and model forests of each class are required in as many places as possible in the country, so as to serve as training grounds for future foresters.

In order to meet this want of a training ground in Scotland-Mr Munro Ferguson, M P, President of the Royal Scottish Arboricultural Society, proposed to apply for a parliamentary grant to purchase an area of waste land and plant it up gradually, so as to form a normal high forest with trees of all ages corresponding to a rotation of say 100 years Dr Schlich, however, pointed out that it would take at least one if not two generations before the proposed model forest was of any use for instruction in forestry, and suggested that the Commissioners of Woods and Forests should engage an expert to draw up working plans (schemes) for a number (if not all) of the forests under their control and then see that the provisions of these working plans are intelligently carried out In this way their own subordinates would be trained in the course of time and the work going on in these woods would afford the means of instructing new hands to be employed in the Crown Forests and private estates

It is very gratifying to know that the Woods and Forests Department has adopted this plan Mr H C Hill a Conservator of Forests to the Government of India who has acted for sometime as head of the Indian forest service, and is now at home on furlough, is engaged in preparing Working Plans for the High Meadows wood and the forest of Dean, and if this excellent policy is continued, working plans will eventually be made for all the Crown forests and a foundation laid for scientific and economic forestry in Britain Unfortunately there are not, I believe any Crown forests in Scotland or Ireland and the only apparent way of providing model forests in these countries is for certain private land owners to manage their woods on similar principles to those now being introduced into the Crown forests of England

The next step required from the Woods and Forests Department, without which, these plans for improving the management of their woods will be of no avail, is for them to train a superior staff for the management of the Crown Forests by attracting men of good general education into their service, who have received a professional forestry education at Coopers Hill Two appointments as Assistant Conservators of Forests on salaries from £200 to 400 per annum, should be established in each of the Dean, Windsor, and New Forests under the present Deputy Surveyor The emoluments of 3 Deputy Surveyors, including houses and land attached, are each worth about £900 a year, and on the occurrence of vacancies in these appointments for which the appropriate title of Conservator of Forests should be substituted for the anomalous one of Deputy Surveyor, these posts should no longer be given as a reward for political services but to the best men from among the Assistant Conservators Besides the large areas of forest comprised in the Windsor New, and Dean Forests, there are several outlying Crown forests, such as the Delamere Forest (5 000 acres) Salcey woods (1,266 acres) woods in the Isle of Man, &c Men of the grade of Assistant Conservators should be placed in charge of the more important of these woods, thus rendering a uniform system of control practicable and saving the present agency charges and also of any extensive plantations which may be started in the 300,000 acres of Crown land, or elsewhere

Another official of similar rank to the Conservators of Forests, acting under the orders of the Commissioners, should be appointed at the Woods and Forests office to control the execution of working plans for the Crown Forests and to form new plans and revise old ones from time to time Once it is recognized that the Woods and Forests Department has the disposal of the services of a number of trained men, no colonial forest appointments need in future be offered to foreigners, as has been already the case at the Cape, Natal, and Cyprus, but to one of the Crown Assistant Conservators of Forests Inattention to forestry at home has been followed by indifference in the Colonies although the permanent maintenance of the indigenous forests is a question of vital importance to most of our dependencies, but the fact that Britian is setting her house in order in this respect will probably induce colonials to follow suit and imitate the splendid and successful policy of India in this respect It is clear that a subordinate grade of woodmen will always be required as at present in the Crown Forests, a graded service of this order should be established and, when once the Crown Forests are brought into proper order, private landowners will be inclined to apply to the Woods and Forests Department for trained woodmen for their own woodlands.

As regards education in forestry, Dr Schlich has stated that little can be done until we have a relay of competent men trained in systematically managed forests, and capable of lecturing and that the less said the better about lectures in forestry merely prepared from books. The Forestry Branch at the

Royal Indian Engineering College, Coopers Hill, has the Indian Forest Service to indent on for a succession of practical men as forest lecturers, and this College can train men for superior service in forestry in the colonies, as well as India, and also instructors in forestry for Colonial Forest Schools, as soon as the colonies perceive the necessity for them But in order that landowners and land agents may possess sufficient knowledge of forestry to direct the management of the private woodlands in Britain, classes in forestry must be established at all our universities, as at present at Edinburgh and Durham. It is very gratifying to hear that Professor Warrington at Oxford has, by the liberality of Miss Ormerod and others been provided with funds to start the teaching of forestry in connection with agriculture, and that a course of lectures in rural economy by Professor Somerville has been given at Cambridge At Edinburgh there have hitherto been divided counsels and the professor of Botany has started a course of forestry instruction in opposition to that given by Colonel Bailey, one of the best of our foresters It is to be hoped that these divided counsels will be abandoned in favour of consolidating forestry instruction on a thoroughly practical basis. The reception Dr Schlich met with at Edinburgh last spring when he gave an address on forestry to the members of the Royal Scottish Arboricultural Society, and again at the Imperial Institute when he read a most valuable and instructive paper, on the timber resources of the British Empire, shows that the time has come when a great step forward must be made in British forestry, and the recent patriotic action of the Commissioners of Woods and Forests in preparing the Crown Forests as training grounds for the future foresters of the Empire, show that the present Government have clearly recognized their obligation in this respect

While, however, every British Forester must desire that his profession should become thoroughly indigenous and be well illustrated at home by well managed examples of varied woodlands, we should never forget the debt we owe to French and German foresters who by their courteous reception of English Forest students for the last 30 years in their magnificent forests, have prepared the way for the present revival of Forestry in Britain —*Land Magazine*

Sir Dietrich Brandis' Pamphlet.

There can be little doubt that the father of Indian, if not of Madras, Forestry was Dr. (now Sir Dietrich) Brandis. If we in this Presidency had produced a Cleghorn and a Beddome before the advent in Madras of the distinguished German who was for twenty years Inspector-General of Forests to the Government of India, the effect of their labours had been but local. Throughout the greater part of India systematic forestry owed its very commencement to Dr Brandis, and the Indian Forest Department was unquestionably created by him. He possessed the supreme advantage of having secured the confidence of the Government of India. All Governments in India have to decide a vast variety of questions of which they are crassly ignorant and being ignorant they are suspicious and afraid of being imposed on. The Government of India's ignorance is the most extensive, because its range of power is greatest, and it is of course proportionately nervous of being taken in. The first thing, therefore, which the head of a Department must do, if he would advance is to make the Government of India believe in him. Once this is accomplished it will follow him like a little child. Dr Brandis succeeded in the operation. Beginning with Lord Lawrence who was by no means a warm supporter of the new Department he gradually built up a reputation as a safe and strong man. In Province after Province the re-organisation of the Forest Department was carried out on the lines he laid down. In 1881 he visited Madras, and the result is to be seen in the Madras Forest Act of 1892, under which all subsequent forest operations have been conducted. In 1884 Dr Brandis retired, being rewarded by the bestowal of a K.C.I.E., and he has now published a *brochure* in which he traces the course of Indian Forestry and endeavours to suggest the lines of its future development. It is not unnatural that the veteran, who has so long controlled the destinies of the Department, should hope still to direct its course; still more natural that he should wish to recall his achievements in the past, but it must be added that distance from India frequently lends an enchantment incompatible with rugged realities and that the removal of responsibility has an astonishingly enlivening effect on the once staid official pen.

Sir Dietrich Brandis' main recommendation in the pamphlet under notice is the extended employment of Natives in responsible offices of the Forest Department. Like a well trained man, he first supports his proposal by a quotation from Sir Thomas Munro, whose Minutes have been a perfect gold mine of quotations to official writers ever since Sir Alexander Arbuthnot rendered them accessible. Then he points out that Native Forest Officers possess the great advantage that they cannot be accused of "want of sympathy" with, or "absence of knowledge of the people." Lastly, and with most force, he urges that unless systematic Forestry is accepted by the educated classes of India as a sound principle, it must remain an exotic and would immediately expire were the foreign influence supporting it removed. Forestry must be naturalised in India if it is not to be looked upon as an alien invention, and naturalisation can be best effected by raising Natives of the country to responsible positions in the Forest Department The Dehra Dun School must be strengthened and extended Similar schools must be established in other parts of the country notably in Burma As Japan sends young men to Germany to study in the forest schools of that country, so India should send the pick of Dehra Dun to complete their forest education on the Continent of Europe 'It will be a great point gained when the first Native 'is appointed to the post of Conservator of Forests Such are Sir D Brandis proposals And it must be admitted that he does not altogether omit to notice the difficulties of his scheme, namely the failure of Native Forest Officers in the past and the extreme scarcity of suitable Native candidates He believes, however, that if "an honourable and paying career' is assured, desirable candidates will not be wanting, and in the matter of successful native working he appeals to the evidence of Native States such as Mysore But we may well doubt whether the matter is so simple as it looks The educated classes in India are unfortunately specially ill suited for forest employ The Brahmin and his non-Brahmin imitator has neither taste nor capacity for jungle work His physique is generally unfavourable and his indifference to natural history deprives the Department of one of its chief attractions Mr Dansey Conservator in the North-West Provinces is quoted by Sir D Brandis as writing —'The 'most unprofitable of all subordinate Forest officers is the town bred 'schoolboy who has no previous experience of jungle life jungle tribes and jungle conditions generally Hence if the ordinary Cutcherry recruit is enlisted in the Forest Department he will be willing enough to visit Germany at the public expense and to enter the higher ranks of the Department but he will be as far as ever from being a practical Forester Already the wholesome rule with which the Dehra Dun School started has proved unworkable, viz that no student should be received who had not proved his fitness for the Forests by several years' work as a volunteer or forest guard The problem is not to be met, as Sir D Brandis suggests merely by offering better pay and prospects which would only attract the usual place-hunting class A practical test in active forest work must be imposed A stringent physical examination must be insisted on and candidates must be looked for among the more robust and active, rather than among the most intelligent, classes. Even so, the measure of success will not be high and forest administration will probably long remain largely in the hands of the European and European descended races

The remainder of Sir D Brandis's proposals are directed to the legitimate extension of forestry in India The steady growth of population, he points out, necessitates the extension of forests, otherwise the increasing demand for forest produce must in the end outrun the supply He especially insists on the paramount importance of maintaining the minor forests and pasture lands. The large timber forests furnish the backbone of the departmental revenue, but it is to the smaller areas that the people have to look for their local supplies of forest produce, as well as for pasturage in the dry season. Sir D Brandis gives an interesting account of the results which followed the handing over of the waste and jungle in Ajmere and Merwara to the inhabitants In a few years the hills were cleared of trees, the reserves of pasture were gone and the tanks were destroyed by the torrents which poured unchecked down the hill-sides. The effects on the population were most serious. A similar story has to be told of the Hoshiarpur District of the Punjab, where 7,000 acres of fertile land have been laid waste by torrents coming from the denuded hills The importance of pasturage in seasons when the rains fail is rightly insisted on, and Sir D. Brandis makes a protest, albeit in diplomatic language, against the Government of India's recent policy of establishing settlements in the heart of the more remote forests and of relinquishing minor forests for cultivation He advocates, on the contrary, the establishment of village forests, such as exist in Germany But when he goes on to suggest that the selection of such tracts should as far as possible be intrusted to Native agency and apparently left to Municipalities and local bodies, it is clear how the leaven of retirement has entered into his soul "The blessings of progress," he tells us, "will be valued more by the people, if they are not 'all dispensed by the hand of the foreigner." The blessings of forest progress are seldom appreciated at all by the people, but we may well pity them when these blessings are bestowed and controlled by the incorruptible agencies referred to.—*Madras Mail.*

Concentric Rings in the Mangrove.

The Madras Report for 1895-96 has the following " It was
'found in the Kistna District that the annual growth in diameter
' of the mangrove (*Avicennia*) amounts to nearly an inch and from
' 1 to 2 feet in height. It is considered that the spurious rings
'are monthly and are probably due to the different conditions of
'nutrition caused by the spring and neap tides."

We would ask other officers in whose districts mangrove forests lie to verify this statement and enquire and examine whether any of the mangroves put on a ring showing the completion of a periodical growth once a month, whether all species exposed to the influence of tides do so, or only some and whether they do so every month, and send the result of their investigations for publication in *the Indian Forester*.

Insect ravages among Teak and Anogeissus latifolia.

Teak in the whole Southern portion of this District has been entirely defoliated by a small caterpillar In 1892 the same thing happened in the Ahiri Forests in Chanda I tried then to get the mature insect from the caterpillar but unfortunately all the insects I had collected were attacked by Ichneumon flies and came to nothing The parenchyma of the leaf is only eaten, the veins and midrib being left intact Hardly a single tree has escaped, and the whole forest where teak predominates has a sombre brown appearance

Dhaura (*Anogeissus latifolia*) has also suffered badly In this case however, the entire leaf is eaten and Dhaura is now beginning to send out a few bunches of new leaves The damages have extended over a large area and in some localities not a single tree has escaped In 1892 Dhaura suffered by the same insect This was also to be observed in the Ahiri reserve I wonder if this is the case in other Districts as well Unfortunately I have to travel about fast and can take very little luggage, or I would try and collect and identify the above insects On the 27th I traversed 32 miles, principally though Teak forest and I cannot recollect seeing a single tree that had entirely escaped Many did not show a single green leaf I cannot say how the rest of the District has fared as I have not seen it since the commencement of the rains

R C THOMPSON

CAMP DAMOH, C P
29th July, 1897

Oil Buchanania latifolia Seeds.

Buchanania latifolia is locally known as *char* or *achar* in the Central Provinces The fruits, which ripen in May are much eaten by the natives, the cotyledons inside the seed locally known as "*chironji* ", being the parts used, which are eaten either raw or made into a sweetmeat with sugar Apart from this use, the cotyledons give an excellent colourless, tasteless, and inodorous oil Up to the present time the Gonds and Korkoos have not extracted the oil to any great extent, though they knew of its existence and though I made an extensive enquiry, I have been unable to discover any local use of the oil

The oil is extracted by the Gonds and Korkoos in an ingenious way which was only adopted by me when all other means failed The method consists of —first pounding up the cotyledons into a coarse paste in an "*ukhree*"* care being taken not to have it pounded too fine, as the finer the paste is, the less the quantity of oil secured—the paste is then exposed to steam for a quarter of an hour by putting it in an earthen pot with a hole in the bottom, placed over a narrow necked earthen pot containing water kept at boiling point. Thirdly, the hot paste is neatly tied up into a bundle in a piece of blanket and is then ready for pressing The paste is twice put through the above process, after which it ceases to produce oil.

The press consists of two logs of equal dimensions, each with one side roughly squared and with holes bored in one of the extremities, through which a stout rope is passed forming a kind of hinge. In addition, the lower log is also provided with a disk, at about a foot from the hinged end, surrounded by a groove with an outlet for the oil to escape, the disk slopes on all sides towards the groove which is about an inch in breadth and depth. The bundle containing the hot paste is put on the disk and the upper log placed on top of it. The free ends of both logs are then drawn together by means of another stout rope and as the pressure increases the oil comes out.

From actual experiments conducted by myself, I found that about 2 lbs. of the cotyledons produce about ½ lb of oil

S. N C.

5th August, 1897

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* A native contrivance for pounding any kind of grain.

VII TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

5th July, 1897

EAST INDIA TEAK —The deliveries for the first half year of 1897 totals 9,357 loads as compared with 10,461 loads for the first six months of 1896 For June this year the figures are 956 loads against 869 loads in June, 1896 The market has been apparently inactive and uninteresting, sellers taking business to a shade under their quotations, rather than holding out for the highest prices The market ahead is very quiet in the absence of unsold floating cargoes

ROSEWOOD —EAST INDIA — Small shipments would sell well, as there is a good, although not large, demand

SATINWOOD—EAST INDIA—There is a good demand for *Figury* wood in either *logs* or *boards* but not much enquiry for plain wood

EBONY.—EAST INDIA —For small lots of good wood fair prices could be made

PRICE CURRENT

Indian teak	per load	£10 10s	to	£15 10s
Rosewood	„ ton	£8	to	£10
Satinwood	„ sup foot	8d	to	12d
Ebony	„ ton	£7	to	£8

Teak Circular for July.

Messrs. Denny, Mott, and Dickson report —4,108 loads of logs and planks were landed in the London Docks last month, against 990 loads delivered into consumption The Jubilee holidays undoubtedly restricted the deliveries The London stocks now stand as follows —

	1897.		1896.	
	lds		lds.	
	8,222	logs	6,307	logs
	2,042	planks	2,517	planks
	24	blocks	65	blocks
Total ...	10 288		8,889	

The following are the comparisons between the past half-year and the corresponding one in 1896 —Landings in London Docks from January 1st, to June 30th, 1897 —7 850 loads, as against 9,464 loads for the same period in 1896 Deliveries from

London Docks from January 1st, to June 30th, 1897 :—9,225 loads, as against 10,778 loads for the same period in 1896. The deliveries have been satisfactory, as those for the same period last year were unprecedentedly high. A large proportion of the above moderate import of 7,850 loads has been of inferior quality and the dwindling quantity of good merchantable wood has commanded high prices, whilst even the inferior wood finds outlets at prices far above its deserts. This influx of indifferent wood is, however, causing such dissatisfaction to consumers, that architects and engineers in many cases specify other wood than teak for many purposes where it used to command the preference ; and although a lowering of the standard of quality may have been inevitable owing to the European demand outrunning the available supplies of good wood at the shipping ports, the bad quality of many of these speculative shipments is calculated to seriously lower the character of teak in the estimation of those who have considerable influence in causing it to be used for naval, rolling-stock, and domestic purposes

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MARKET RATES OF PRODUCE.

Tropical Agriculturist, July, 1897.

Cardamoms		per lb	3s.	to	3s. 1d.
Croton seeds		per cwt.	85s.	to	86s.
Cutch		„	9s. 3d.	to	32s. 6d.
Gum Arabic, Madras		„	35s.	to	40s
Gum Kino	„	„	£45	to	£55
Indiarubber,	Assam	per lb.	1s. 9d.	to	2s. 4d.
„	Burma	„	1s. 4d.	to	2s. 1d.
Myrabolums,	Bombay	per cwt.	4s. 3d.	to	8s 6d.
„	Jubbulpore	„	4s.	to	7s.
„	Godavari	„	3s 9d.	to	5s. 6d.
„	Calcutta	„	4s.	to	6s.
Nux Vomica, Good		„	7s	to	7s. 6d.
Oil, Lemon Grass		per lb	2⅜d.		
Orchella, Ceylon		per cwt.	10s.	to	12s. 6d.
Sandalwood, logs		„	£30	to	£50.
„	chips	„	£4	to	£8.
Sapanwood,		„	£4.	to	£5.
Seed lac		„	70s.	to	80s.
Tamarinds		„	4s.	to	6s.

THE
INDIAN FORESTER.

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Sir Richard Strachey and Indian Forestry.

The readers of the 'Forester' doubtless have noticed the name of Richard Strachey in the list of Diamond Jubilee Honours. To him is entirely due the present organization of the Forest Department, and this fact has never been sufficiently recognized. When in February 1861, the Government of India ordered the Pegu Forests to be thrown open to private enterprize these orders were issued in the Foreign Department, which at that time controlled the entire administration of that newly-annexed province In November 1861 the measures taken by the Government of India were objected to by Her Majesty's Secretary of State But before his despatch had reached Calcutta the subject had once more been considered by the Government of India, and doubts were entertained, whether it had been right to deviate from the policy laid down in regard to the Pegu Forests by Lord Dalhousie Accordingly it was determined, for the future to deal with questions of Forest Administration throughout the Empire, in one Department of the Government of India As the then Secretary in the Public Works Department, Colonel (afterwards Sir Henry) Yule and his successor then Colonel Richard Strachey, took a special interest in forest conservancy, that Department was chosen

Thus when in the autumn of 1862 the writer of these lines was called away from Rangoon to assist the Government of India in the organization of Forest business in the other provinces, Richard Strachey was his Chief In Pegu it had been my privilege to serve under Colonel (afterwards Sir Arthur) Phayre, and now it was my singularly good fortune to commence my work in a more extended sphere under one of the ablest Indian Statesmen of our time At that time, Lord Elgin was Governor-General of India He died in November 1863 and Sir John (afterwards Lord) Lawrence landed at Calcutta in January 1864, Lawrence had saved the British Indian Empire in 1857, mainly through the resources of the Punjab and the fidelity of its people By strong, just and considerate Government he had firmly attached them to British rule, and this result he had attained by insisting upon personal Government by his district officers He held that the chief civil officer must be supreme in his district and that there must be no departmental interference of any sort Before going out as Governor-General he had seen the despatches sent home regarding forest administration and he did not approve of the plan of establishing a new Department, that would have charge of the waste lands and forests and that might in many cases interfere with the supreme authority of the chief civil officer in his district It was no secret that Lawrance had determined to stamp out this new-fangled scheme I felt my position untenable, and begged Strachey to let me go back to Burma, where I wished to continue the work which I had commenced He asked me to have patience, to put up with the unsatisfactory state of things, and to remain attached to the Government of India Gradually, Richard Strachey obtained sufficient influence over the Governor-General, to enable us to do useful work in India Sir John Lawrence soon learnt to value Colonel Strachey's powerful help in extending irrigation works on a large scale and, later on, in devising a system of Railways to be built by the State It was due to Richard Strachey's steadily growing influence and to the patient perseverance of his successor as Secretary to the Government of India that in 1868 Sir John Lawrence sanctioned a definite organization of the Department in all provinces under the Government of India Had it not been for Richard Strachey, Forestry would have come to nothing under Lawrence What I have here stated in no way detracts from the high position Lord Lawrence justly holds in the history of India The creation of a separate Forest Department at that time was regarded as a most doubtful measure by the majority of Civil Officers Even at the present moment, many distinguished Indian Officers view the present progressive and Departmental system of Government as a source of real danger to British rule in India The system which after much opposition has been arrived at of making the District Forest Officer the Collector or Deputy Commissioner's Assistant and which effectually guards against all political risk, could not have been introduced in those early days, because at that time it was necessary to give the Conservator power to take the initiative in forest matters and to carry out his plans through the agency of his Assistants, acting of course always under the orders of the Local Government

Richard Strachey's eminent services in India have long been universally recognized, and outsiders have often wondered that he had always remained plain General Strachey His friends knew that it was not in his nature to care greatly for the decorations, by which public services usually are recognized, and he had been successful repeatedly, in warding off the attempt to confer such titles and decoration upon him This time however Lord Salisbury did not ask his leave, and thus we have now the great satisfaction of honouring him as Grand Commander of the Star of India In spite of his 80 years, Richard Strachey still is hard at work in connection with Railways He is chairman of the East India and of the Assam-Bengal Railway Companies, and his interest in Indian Forestry is undiminished The above brief sketch of what Strachey has done to place forestry in India upon a safe footing is intended as an introduction to some important remarks of his on the aims and objects which foresters in India should keep is view These remarks he communicated to me in a letter of 16th inst and they are as follows —

"If I may add a word of criticism on the position of the Forest Department at the present time, so far as my information on the subject goes it would be that it is still only in the stage of preserving what exists and laying a foundation for what may be It is still a blot on its administration, that it is with the greatest difficulty, that timber sleepers can be got for our railways even where they pass through forests, as in Assam Why should I have to send to Norway for pine poles to be used in making a railway between Benares and Gya ?"

The attitude of Government, I am aware, is opposed to efforts to make the Forest Department commercially active and the fear of interfering with private enterprize stands in the way of much that could be done towards developing industries in India, the absence of which is one of the main causes of the relative poverty of the country and the inability of the people to resist the pressure of times of scarcity So long as the people is exclusively agricultural or nearly so and the numbers are double what are required for the proper cultivation of the soil and the production of food, what else can be expected but a total incapacity to accumulate wealth ? The difficulty in the way of getting out of these conditions is, of course enormous, and cannot be overcome otherwise than with extreme slowness But the object should surely be never lost sight of, and what is possible should be done to open the way to its realization if it is to be postponed even for a century "

Laissez faire is not the remedy for the evils that oppress the vast majority of mankind"

So far Sir Richard Strachey. In these lines he briefly indicates the great task which the British nation has undertaken in the Government of India, a task which can only be accomplished by the patient, but carefully planned, work of generations The resources of the different provinces of that huge Empire must be developed in such a manner, as to generate and feed industries, that will increase the well-being of the agricultural population and will enable them to resist the pressure of scarcity when their harvests are diminished or destroyed by drought Such industries as shall promote the well-being of the agricultural population, obviously must be fed chiefly by the produce of the soil. The great aim therefore to which the efforts of public officers in India ought to be incessantly directed is to increase the growth of useful products that will give profitable employment to the people

Where there are forests or where forests can be raised, the greatest production of timber bamboos and other useful forest produce on the area available ought to be the aim Well may Strachey complain that to this day timber for railway construction must be imported from Norway and that even where railways pass through forest timber sleepers can often be got with the greatest difficulty True one difficulty consists in this, that among the vast variety of trees in the forests of India a few only produce timber that will resist the climate and that will last sufficiently to be useful as railway sleepers, further that these kinds, which yield durable wood are mostly scarce and that their timber can be more profitably disposed of for other purposes Another difficulty is that vast areas are without forests or without forest at the disposal of Government The forests through which the Assam-Bengal Railway runs produce no Teak, Pyinkado or Sal timber and the Nahor (*Mesna ferrea*) one of the few really durable woods which grow there probably fetches higher prices for other purposes Hitherto I understand Pyinkado sleepers have been imported for the line and the question whether *Mesna ferrea* may be made available for that purpose is being seriously considered There may however be timbers in the vast forests in the vicinity of that line which though not as durable as Nahor or Pyinkado yet may furnish sleepers for the first construction of it The rapid completion of the Jabulpur and Nagpore branches of the Great India Peninsular Railway about 1866 was made possible by employing sleepers of *Terminalia tomentosa* and other woods, which though not as durable as Teak or Sal yet are sufficiently so to justify their use at the commencement In those days Sir Richard Temple was Chief Commissioner, and Colonel Pearson was Conservator of Forests in the Central Provinces The forests nearest to the line Benares-Gya which are at the disposal of Government are the Palamau, Gorakhpur and Oudh forests In these there ought now to be sufficient second growth of Sal, to furnish thinnings of Sal poles One would think that by this time a sufficiently steady demand for Telegraph posts ought to have sprung up to make poles of Sal an article of trade Nevertheless it is quite possible, that in many cases with the low rates of outward freight, it may still be possible to deliver impregnated poles of Spruce from Europe at prices lower than those at which durable Indian timber, such as Sal Teak, Deodar are ordinarily sold in the Indian market

When after leaving Burma in the autumn of 1862, I commenced work in Northern India, difficulties frequently arose, in the course of direct dealings between the Public Works Department Railway Companies or contractors, and those officers who at that time worked the Government forests Sudden demands were made for large quantities of seasoned timber to be delivered at a few months' notice, rejections of the timber delivered were frequent and often arbitrary and the dealings with the subordinates sent to take charge of the timber were not always satisfactory For many cases it was found better to employ middle men in this business Theoretically the best plan would always be, to sell all timber standing in the forest, or, where rivers are available for floating it to the market to sell the timber ready for launching. The work of forest officers would then be confined to the forests It has frequently been urged, and with much appearance of justice that in many cases forest officers in India have a great deal of deal of work to do which is scarcely fit work for a Government Department On a vast scale they discharge the functions of a private trader they have to watch the state of the market, to enter into competition with other traders and find customers for their stocks of timber Many attempts have consequently been made in different provinces to sell the timber standing in the forests and thus to set forest officers free for their more legitimate work in the Forests and in many forest districts these attempts have been most successful This however cannot everywhere be accomplished But wherever forest officers have to engage in timber operations on a large scale an excellent plan is to establish timber depots at suitable places and to hold periodical auction sales regularly at stated times Under such an arrangement Contractors Railway Companies and the trade generally, gradually learn that at certain dates timber is available at these depôts, the price is regulated by the demand and under such an arrangement forest officers have not to assume the functions of private traders I certainly never did a better thing than when I obtained, a few days after landing at Rangoon in January 1856 from the then Commissioner Major Phayre, a piece of river frontage 1½ miles long There all the timber brought from the forests was collected and sold by public auction at monthly sales After 1861 when, in obedience to the orders of Government, a large portion of the forests were thrown open to private enterprize under the permit system the quantity of timber disposed of at these sales diminished, but in course of time the permit system came to an end and to the present day the greater part of the Teak timber produced in the Pegu forests is sold by periodical sales at the Rangoon timber depôt Similar depots have at different times been established on the rivers which take their rise in the Himalaya for the sale of Deodar and other timber brought down on Government account, and in my opinion this system might, whenever possible, be encouraged The system to be pursued in the disposal of timber and Bamboos grown in Government forests must however always be arranged in accordance with the circumstances of the case it must not be regulated by rigid principles or in obedience to pre-conceived notions

When regular forest management was commenced in India, a few kinds of timber only were marketable chiefly those, which like Teak, Sal and Deodar were known to resist the action of decay and insects in a tropical or sub-tropical climate Clearly however, it is one of the most important duties of Indian Foresters to seek employment for those kinds also, which formerly were not regarded as marketable, and which were generally classed as inferior kinds The importation of foreign timber into India, mostly of spruce impregnated with creosote, and of timber from Australia, has at times been considerable, and it certainly ought to be the aim of foresters in India, as far as timber is concerned, to make the country independent of foreign supplies

A great deal has been accomplished in this direction As soon as I had secured an annual surplus revenue by the sale of the old Teak timber from the Pegu forests, I brought down regularly to the Rangoon timber depôt large quantities of other woods, carefully selected logs, which were sold by auction at the monthly timber sales Financially this was a loss but a few kinds were brought to notice in in this manner The first real start however was made with Pyinkado by Mr Ribbentrop when Conservator of Forests in Burma between 1875 and 1877 The difficulty was, to procure a saw mill fit to cut up this extremely hard wood This difficulty overcome, Pyinkado was used largely for the Railways in Burma and in other provinces sleepers of this wood have even been exported to Africa and I understand that 10 to 12 local saw mills are now at work in Burma for its conversion In 1895-96 Government is reported to have derived a revenue of three lakhs from the Pyinkado timber trade in Burma Another instance is the export trade of Padauk timber from the Andamans, which has gradually become of considerable importance and in the School Forests of the Himalaya I am told that trees of *Pinus excelsa* and *longifolia* now sell at good rates standing in the forest, timbers which 15 years ago were unsaleable

What has not yet been accomplished is, to increase the durability of other kinds by impregnating them The efforts that will doubtless ere long be made in this direction, will I hope eventually lead to the establishment of factories for impregnating Himalayan Pines and other woods As I explained in the paper on the utilization of the less valuable trees, which was printed in the Indian Forester of February 1894, I have ever since 1875, as long as I was in India, done my utmost to bring the establishment of impregnation factories in Northern India It is a most remarkable fact that hitherto no effective action has been taken in this direction I am glad however to notice that the rise in the price of Deodar timber in the Punjab has lately again directed attention to this subject

Nor has any effective action been taken to employ the wood of the inferior kinds in order to encourage the manufacture of iron with charcoal or to obtain acetic acid and other useful products by carbonizing it in closed kilns, On these subjects I have so often written at length lately * that I will not weary the patience of my reader by repeating what he may have read already Most satisfactory results have, I understand, been attained in the School forests of Jaunsar by the disposal of pitch and resin, the produce of *Pinus longifolia*

Another industry that might be stimulated through the action of foresters in India to a greater extent than has hitherto been done, is the tanning of hides Tanning materials and raw hides are important articles of export There is no reason why an extensive tanning industry should not be developed in India I remember with pleasure a ludicrous sight that used to be common in many villages in Rajputana and elsewhere Long rows of goat skins hung up stuffed with the leaves of *Anogeissus*, and along these rows a number of little boys busy pouring water into the open throats of these stuffed goats the skins of which were thus being prepared to furnish the finest possible leather Tanning materials are abundantly produced by the vegetable kingdom, new tans are constantly being brought to notice in different countries, and many such may still be discovered in India I have learnt with great satisfaction that it is contemplated to establish a central research station for forest products at Dehra Dun in connection with the Forest School and that the Officer in charge will have the advice and assistance of the Agricultural Chemist to the Governmant of India In the present instance however I desire specially to draw attention to a substance which has long been used by tanners and which is an article of trade in Northern India, the bark of *Acacia arabica*

I understand that in consequence of the offer made by a large European firm at Cawnpore to take annually 250 000 maunds of Babul bark at 8 annas per maund, an enquiry has lately been set on foot, by Mr Ribbentrop the Inspector-General of Forests, whether it would be advisable to establish plantations upon a large scale to supply the bark and at the same time to increase the supply of fuel in the forestless country of the North-Western Provinces I also understand that the Conservator of forests and the Divisional Officers of the Central Forest Circle have pronounced against the scheme and that it has consequently been abandoned

It was estimated, that the scheme would require the taking up of 84 000 acres which under a 12 years' rotation were estimated to yield at the rate of 3 maunds of bark and 60 cubic ft of barked and stacked fuel per acre per annum, an annual outturn of 252,000 maunds of bark and 50,40,000 cubic ft of firewood It was also estimated that the area required could be purchased at about 14 rupees an acre and that if the purchase money and the outlay on formation and maintenance were capitalised at 4 per cent, the amount would show a deficit, but that if the calculation were made at 3 per cent, the net revenue obtained from the 84,000 acres proposed to be operated upon, would amount to Rs 44,000

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* Utilization of the less valuable trees Indian Forester 1897 page page 57

† Vœlcker, on the improvement of Indian Agriculture London 1893 page 758.

I can quite understand the disinclination of Forest Officers in the North-Western Provinces to embark in an undertaking upon so large a scale, the financial success of which is by no means assured Doubts were expressed, whether the produce in firewood of the proposed plantations could be disposed of at a profit and it was urged that the creation of extensive forests for the production of Babul bark and firewood in the centre of these provinces would close the door to all prospects of a trade in tanning materials from the existing forests, while it would at the same time affect injuriously the growing export of fuel

Evidently it is the fear of diminishing the net revenue of forest administration, that makes forest officers unwilling to embark in such undertakings Nor is this fear unreasonable, for as matters stand at present even those public men who are in positions of influence in England as well as in India, and at the same time are well disposed towards regular forest management, as a rule judge the value of forest administration only by the net annual revenue it produces A diminished surplus is regarded as proof of bad management It is to be hoped that in course of time broader views will prevail, and that the work done by foresters in India will be judged more by their success in increasing the quantity of useful products obtained from the soil, in augmenting the productiveness that is the capital value of the estates entrusted to their charge, and thereby contributing to develop the resources of the country

If at the present time financial considerations prevent large operations in this direction there can be no possible objection to taking in hand smaller measures by way of experiment and it seems most important to urge the necessity of such experiments, which must however be undertaken on a sufficient scale to furnish practically useful results On pages 58 to 60 of his excellent report on Indian Agriculture Dr Voelcker gives an account of the experiments made in different districts of Northern India for the purpose of reclaiming Usar lands The result in all cases has been, that if cattle are kept off and are not allowed to nibble away and to tread down every blade of grass, as it appears, the worst Usar will rapidly clothe itself with grass Further, trees can be raised on Usar land, this has been proved for *Butea frondosa* in the Kapurthala State and for *Acacia arabica* at Aligarh It is true that when in the latter experiment Babul had attained a height of 20 feet it seemed to reach a subsoil of Kankar and die But in order to produce firewood and Babul bark for tanning, a short rotation of 12 years is contemplated, and the trees need not attain more than 20 feet in height Usar lands are very extensive in the North-Western Provinces and in the eastern portions of the

Punjab. At Amramaau Mir Muhammad Husain, the Assistant Director of Agriculture, North-Western Provinces and Oudh, in 1882 purchased on behalf of Government 52 acres of Usar land for experiment at one rupee per acre. When Dr Voelcker wrote,† one half of the farm had been reclaimed and was let at an annual rent of eight Rupees per acre. In this case no trees were planted but the reclaimed land gave excellent field crops.

These Usar experiments have been objected to because as a whole they have not been a financial success. Obviously this is no reason why they should not be continued with another object in view viz. that of growing Babul on a short rotation for the production of fuel and bark. The larger scheme of taking in hand 84,000 acres was based upon an excellent Memorandum by Sir Edward Buck of 29th December, 1889 and a note by Mr H. C. Hill, Officiating Inspector-General of Forests of 1st January 1890. These two papers have I understand, been made public, they should be reprinted in the "Indian Forester" so as to give foresters in Northern India an opportunity of fully considering the important questions involved in the proposals made by these two distinguished officers. Sir Edward Buck justly urges, that the only possibility of materially improving the agricultural character of land in the North-Western Provinces, and especially of those tracts which are subjected to the exhausting process of canal irrigation is by providing the people with the means of substituting other fuel for cowdung, which will then be available for manure, and by adding to the amount of leaf and vegetable manure. This lies at the bottom of all attempts to improve the condition of the people in the over populated districts of the country. Dr. Voelcker justly says "could the produce be increased even by one or two bushels per acre the difficulty of population would be met, but without more manure the soil cannot do it, and the export both of crops and of manures (bones) is removing instead of increasing its fertility. The one way in which alone this question can be solved, is by supplying more wood and thus setting free the manure for use on the land. For this purpose fuel and fodder-reserves must be established." Sir Edward Buck further explains that the Ganges canal runs through many of the large Usar plains which form a very large percentage of the Jumna-Ganges Doab. Successful plantations, he adds, have been established on the worst Usar lands in the immediate vicinity of the main canal, where the roots of the trees get down to the sweeter water percolating from the canal bed.

The essence of the plan proposed by Sir Edward Buck and Mr Hill was to take up blocks of inferior land along the Ganges Canal and to plant them up, and in this manner it was estimated that upwards of 250 square miles or 160,000 acres might be obtained. The work of establishing and maintaining this plantation would be undertaken by the canal officers, with the assistance of a Conservator of Forests in professional matters and a sufficient number of Forest Rangers who had received their professional education at Dehra Dun to carry out the work. On these excellent proposals no action has been taken either by the Irrigation or the Forest Department, nor does the Government of the North-Western Provinces seem to have done anything in the matter. The interests at stake, however, are so important, that it would well be worth while for the leading forest officers in the North-Western Provinces to consider whether they could not carry out part of the scheme. Hitherto the main objection to all such undertakings has been the belief that the ryots themselves burn manure in preference to firewood, and that even cheap firewood would not succeed in replacing that which costs them nothing, while suiting their domestic peculiarities better. To this the reply is that the question has never been put to the test of experiment on a sufficient scale and continued steadily for a sufficient length of time to yield reliable results.

But it is not in the vicinity of the canal only, that plantations ought to be made in the forestless districts of India, in order to provide a more abundant supply of firewood and, especially in seasons of drought, grass and leaves, as cattle fodder. Even in the most densely populated districts the area of waste lands is very large and efforts should be made to utilize portions of this area for the purposes indicated. From the volume of Agricultural Statistics of British India for 1890-91 to 1894-95, compiled in the Statistical Bureau of the Government of India, and which therefore may be supposed to be authentic, I will quote below the area of waste and cultivated lands in a few representative districts in the different portions of the North-West Provinces. In all these districts the column "Forests" is blank. The figures in columns 2-5 relate to 1894 95.

	Waste land Unculturable	Culturable	Current follows	Net area cropped during the year	Population per sq miles (1891)
(1)	(2)	(3)	(4)	(5)	(6)
Aligarh	205422	110645	29734	903289	584
Etawah	242289	266039	29423	544615	430
Cawnp	403469	264878	50903	789245	512
Azimgarh	322036	168150	59156	826641	805

Taking these four districts together, the waste lands occupy 19,83,000 acres, considerably more than one half of the area actually bearing crops. And the Forest Officers can contribute much towards the better utilization of these large areas, as well as of the waste lands in other districts of the open forestless country.

It seems to me that foresters in India do not sufficiently realize the wonderful faculty which trees have in drawing moisture from the subsoil and maintaining themselves alive during seasons of drought. In such years I of have often stood before a mowha tree or in a mango grove, wondering that they were able to draw sufficient moisture from the ground when the country around was dry and parched. True, in the driest and hottest districts of the Peninsula, particularly in Cuddapah, I have occasionally found trees of *Anogeissus latifolia*, which had dried up and had been killed it was said during the years of terrible drought 1876 and 1877. But this was on stony and rocky hillsides, and the fires of the hot season had doubtless added to the effect of drought. This peculiar power of many Indian trees to maintain themselves even in seasons of drought is the forester's most powerful ally in the operations, the necessity of which, I have often ventured to urge upon their attention.

As regards the supply of cattle fodder Mr. Hill says: "The soil cannot be covered at the same time by two complete crops—one of grass the other of trees—and the greater the crop of grass the smaller will be the yield in wood." But he adds: "There must however always be some yield of grass, and while the tree growth is young this may bring in 8 annas or even a rupee an acre." In this respect the main point seems to me to be, that in dry seasons the shade of trees keeps the grass alive, when in the open it has long ago withered and dried up.

My idea is, that it would be a great advantage, to commence operations on selected areas in the vicinity of the canals so as to gain the needful experience, and to train a number of native forest rangers in this special line of work. Competent men would then gradually become available to undertake similar operations in other districts away from canals under less favourable circumstances. On land adjoining the canals they might work under the Canal officers, but elsewhere the work should be done under the orders of the Collector of the district, the Conservator or other competent superior forest officer having the general control of operations in regard to professional matters, and wherever the cost of these operations is to be charged to Forests, also in regard to money and all personal matters.

These remarks do not apply to Northern India only, they apply to most provinces of the British Indian Empire. The extent of the waste lands, not included within the limits of the Government forests, is enormous; by endeavouring to make these lands more productive, forest officers will be able to contribute much towards the well being of the agricultural population. Apart from wood, grass and tanning materials, there are many other useful substances that will thus be placed within reach of the people living in the open, and at present, forestless country. The line of action here submitted to the readers of the "Indian Forester" is one step only in the task of further developing the resources of the British Indian Empire, but if adopted and followed, it will prove to have been a most important step of progress.

BONN, D. BRANDIS.
July 1897.

II.—CORRESPONDENCE

The Cultivatiom of Esparto Grass.

M Schneider in the *Révue des Eaux et Forêts* quotes an English paper to the effect that the Sahara is probably colonisable through the instrumentality of the *Esparto grass*, which grows well there This grass constitutes the greater part of the material used for making the paper of newspapers in Europe, especially English newspapers. The Royal Botanical Society held a conference on the subject last April, and it seems not unlikely that the formation of a company will take place

If the useful Esparto grass grows so well in a place like the desert of Sahara, may there not be places suited for it in India, and where the introduction of the grass will be a benefit to the country itself ?

Q.

14*th August*, 1897.

Forest Literature.

Would it be too much to ask the "Indian Forester" to have a page or two shewing the names of Forest Works, their authors, publishers and prices ? One often desires to obtain a book (at this moment I wish to get M Gurnaud's book) and is unable for want of the above information Moreover many men would purchase books if they knew of their existence I would have the list as full as possible for all English American, French German, Austrian, Swiss, Belgian and Italian works, but for this purpose it would probably be necessary to apply to all the Forest Journals of those countries to keep the "Indian Forester" informed of any new work as it appeared I believe many men would take a pride in having as full a Forest Library as possible, and that is at least a step towards reading These are days of Research Bureaux, (of which it seems to me we are bound to have one sooner or later in India) and nothing encourages research like reading of it elsewhere. The leaders of Forestry in India no doubt feel the necessity for keeping up with the "march of ideas," but their taste will be greatly helped if the service throughout takes to reading and to keeping itself up to date And I take it, all writers on Forestry would be only too glad to let the Dehra Dun Library have a copy or two of their works Thereafter perhaps the Dehra Library would lend such works to officers who wanted to see them, and thus increase its sphere of usefulness.

13th August, 1597. MILES.

Calotropis procera.

You will probably be interested to hear that a representative of a firm (Messrs. Boyle & Company London) is on his way to Bombay for the purpose of undertaking experiments in extracting fibre from the Calotropis procera a plant, the fibre of which has been known to be of excellent quality for the past twenty years or more

A small consignment of the fibre was sent to Messrs Boyle and Company to be reported on who then asked that some of the stems of the plant might be forwarded to them to ascertain whether the machinery they possessed could treat and decorticate the fibre from the stems There was no use of course in doing this as by the time the stems reached England, they would it was known, be too dry, for the purpose of experiment On being informed accordingly Messrs Boyle and Company resolved to send a representative to India with machinery to decorticate the fibre if possible on the spot, and their representative is now on his way to Bombay *via* Singapore He will probably be here in the cold weather The step Messrs Boyle and Company are about to take is a bold one, and it clearly shows that they consider the fibre to be extremely valuable

The next question is is there a sufficient quantity of the fibre available in India at present from stems to enable an export trade on a large scale to be carried out should the experiment turn out a success ? Calotropis procera grows wild all over Sind, and it is also to be found it is believed in the Punjab in this state

Calotropis gigantea the larger plant and one which yields the larger quantity of fibre in proportion to the cut stems is common according to Brandis "in South and Central India Burma and Bengal Gorakpur Oudh and in great profusion in an isolated locality in the Siwalik tract near Kali Dungri below Naini Tal."

The fibres from both the C procera and C gigantea are equally good As at present arranged Messrs Boyle and Company's representative is to proceed to Sind to undertake experiments with C procera there and the Government of Bombay have very kindly issued instructions that all the local Revenue and Forest officers in Sind are to render Messrs Boyle and Company's representative any aid that may be needed for the purpose of conducting experiments with the plant there It may be, however, that there is a better field for such experiments in other parts of India If so, will Forest officers in India and Burma or any others, through the pages of this Magazine, kindly let it be known, and will they also state (1) whether C procera or C gigantea grows in their Districts, 2) if so to what extent and (3) whether there is waste land available for the cultivation of the plants ?

Such information, if it be not too much trouble to obtain, will be extremely useful and valuable at the present time, and I shall be greatly obliged if some, at any rate, will condescend to come forward with it

As C gigantea yields a larger proportion of fibre to the cut stems than C procera and as there may be an equally large quantity of the plant available as in Sind for immediate experiment, in some other district of India or Burma, it might be advisable, after the completion of Messrs Boyle and Company's experiments in Sind for their representative to go elsewhere

An interesting monograph on Calotropis gigantea was written some years ago (1876) by Mr Strettell, Deputy Conservator of Forsets and he described it as being indigenous in Sind He was in error here, for the plant which is to be found in that Province is Calotropis procera Mr Strettell in this paper shows how much more valuable the fibre of C gigantea is than jute and how much easier the plant is of production As regards its facility for producing and reproducing itself there can be but one opinion I have seen it (C procera) growing on the summit of rolling plains of sand away from the Indus and on fallow kharif land near this river It coppices freely and in about 12 months the cut stems are again ready for the extraction of fibre

My experiments in Sind were conducted it ought to be mentioned, with the aid of Ranger Dilpatrai who obtained the cut stems for me and the fibre was stripped from them in my presence

In 1891 Messrs Ide and Christie, Brokers of 7 Mark Lane, London, valued the fibre @ £15 to £28 per ton In Mr Strettell's time the market value of the fibre was £30 to £40 per ton

I imagine its present market value must be rather in accordance with Mr Strettell's figure or perhaps higher judging by the action of Messrs Boyle and Company who are sending out a representative at their own cost and armed with machinery for conducting experiments on the spot They were not invited to come out here but merely asked to report on the quality of the fibre and its market value Their enterprise is certainly very commendable

G. M. R

15th September, 1897

IV–REVIEWS

Fourth edition of Mathieu's Flore Forestiere.

Those readers of the ' Indian Forester" who have had the good fortune of attending Monsieur Mathieu's admirable lectures at Nancy will be glad to learn that a new edition of his "Flore Forestière" has been published. It is the fourth, the third having appeared in 1877, just 20 years ago The present edition has been prepared by Professor P Fliche, Mathieu's successor at the Nancy Forest School

Fliche commences his preface as follows "L'éloge du livre. dont je prèsente une quatrième édition au public n est plus à faire ; tous les forestiers et les botanistes savent quelle abondance de renseignement fruits de l observation personelle de l' auteur ou puisés aux meilleures sources, il offre sur la végétation ligneuse de la France' These are just words of praise for Mathieu's Forest Flora is a truly classical work But the editor properly adds, that during the 20 years which have elapsed since the 3rd edition appeared, botanical science has progressed, and much information regarding the distribution and mode of growth of trees has been collected, and this has necessitated several additions and corrections

It will be remembered that Mathieu's work gave a description of all trees and shrubs growing in France and of the more important species found in Algeria as well as of some trees which, though not indigenous were so extensively cultivated as to have become naturalized Several distinguished foresters had asked Professor Fliche to enlarge the scope of the work by including all woody plants of Algeria This however would have too greatly increased the volume of the work and would have enhanced its price, which it was desirable to avoid The Editor has therefore contented himself with mentioning in their proper place, the more important shrubs omitted by Mathieu Of exotic trees Fliche has added the three species of *Eucalyptus* which are commonly cultivated in the South of France and in Algeria *E Globulus*, *viminalis* and *rostrata*, two North American Oaks *Quercus ilicifolia* and *rubra* The third edition treated of 39 species, while the present book brings up the total to 439 Accordingly the number of pages has increased from 618 to 705

The reader may ask what interest the Indian forester can possibly have in a Forest Flora of France which treats of trees and shrubs, with which he has no concern And yet it is surprising, how many genera of the French forest vegetation are represented in India As regards the temperate climate of the Himalaya, this will probably be conceded even by the most sceptical Not only are the Oaks, the Birches, the Poplars, the Alders, and of Conifers the genera Abies Picea Larix, Pinus and Juniperus represented in the French and Indian forests, but there are species common to both countries such as *Celtis australis*, *Juglans regia* *Platanus orientalis* *Buxus Sempervirus*, *Taxus baccata* and *Cedrus Libani* Both Mathieu and Fliche in agreement with Sir Joseph Hooker, the author of the Flora of British India, regard the Deodar, the Cedar which grows on the Lebanon and the mountains of Asia minor and that, which forms the splendid forests on the Atlas mountains of Algeria, commonly known as *Cedrus atlantica*, as all belonging to one species, the remains of ages long passed away when the climate of these countries Syria and Algeria was moist and cool. The Deodar of the Himalaya, the Cedar of western Asia and of the Atlas mountains must be regarded as the remains of extensive Cedar forests of those remote ages which when the climate gradually became dry and hot, could only maintain themselves at a high elevation.

Apart from the great value of this excellent book as a model of systematic arrangement and of clear and concise treatment on the subject with due regard to the requirements of the Forester, it has a special interest for Indian foresters for not less then one half of the 157 genera described are also found in India.

Bonn, July 1897 D. BRANDIS.

Forestry in the Central Provinces in 1895-96.

The conditions of forestry in the Central Provinces as set forth in the Progress Reports for the year 1895-96 present to an outsider certain marked peculiarities. In that year there was the vast area of 19,567 square miles nominally under the control of the Department whose chief work however apparently consisted in supplying the population resident in or in the vicinity of the forests with the necessities or luxuries of sylvan or rural life, whilst extending to the forests such protection as was in the circumstances possible and at the same time keeping an eye on the doings of the owners of village wastes. These inferences are drawn from the facts that the gross revenue collected averaged about Rs 46 per square mile and that the same limit yielded only 735 cubic feet of timber and fuel green and dry, whilst over one half of the revenue was obtained from the sale of "Forest Stamps," which would seem to be passes of infinitesimal value entitling the purchaser to personally remove produce without supervision. The responsibilities of the forest staff even as above set forth would seem to be sufficiently onerous, but they were at least in one respect considerably lightened, for only 3,000 square miles were closed to grazing all the year round whilst the remaining area was opened, either to grazing or browzing or both, throughout the year. In this fact, implying a prohibition of improvement of forest growth over the larger portion of the area, may perhaps be found one reason for the general absence of timber of a size and quality sufficient to repay foreign export; but when it is considered that in the present circumstances, each grazing beast of all dimensions had some 5 acres of forest land at its disposal, that it is acknowledged that little reproduction could be hoped for in areas open to grazing, and finally that the Chief Commissioner agrees that there is ample scope for the curtailment of the area open to grazing" it strikes the casual

Forest Settlement will have to be notified again, on account of numerous changes of boundary either through the action of the river, or during the Revision Survey, which not only made variations on the ground but altered all the numbers. Demarcation has been delayed chiefly by the sudden river changes, and by the way the Forest Settlement Officer's subordinates had scamped their work. In Mirpur Batoro the situation of the forest area could not be found as all the village boundary marks had been washed away by floods between 1893 and 1895.

Mr Napier was sent down to make a special survey but the river promptly rose and he had to evacuate the country till next season. The demarcation of 176½ miles was done at a cost of Rs 929 or Rs 5-4-3 per mile inclusive of 1982 cairns. The Sind system of getting people to help in exchange for forest considerations, a system that does the forest no harm whatever, creates good feeling and gives the forest officer a useful hold, enabled 484 miles of boundary to be cleared and 11,821 cairns to be put up or repaired free of cost.

Surveyors were busy laying out compartments under the new working plans, and will also have to reconstruct maps of all the riverain forests as these are in some cases so altered as to be unrecognisable. In these working plans the object in view is to prepare rough and ready schemes based entirely on area, for bringing all the forests under systematic treatment, for their improvement as a whole and at the same time to provide, as far as it is possible to do so, for the demands made on them. The fact cannot be disguised that, instead of putting into the market the annual yield of the year, we have often for years past, much against our will been exceeding it. In other words the exploitation has been regulated by the demand and not the demand by the capabilities of the forest. Such a suicidal policy of working cannot be upheld and was put an end to in 1895-96. The area to be exploited having been localised in each block or working circle, its produce alone was made available for the use of the North-Western Railway and other consumers as well as for the local timber markets.

"The basis as regards method of treatment and rotation to suit the trees found in the Sind forests having been decided upon, it is intended to carry on the exploitation of the several working circles in which the forests are being differentiated in accordance therewith until proper working plans are prepared and approved of by Government."

During the year, 152 miles of compartment lines were cut and cleared at an average cost of Rs 7-8-11 per mile.

The usual small expenses in connection with roads and bridges buildings etc were incurred but no large works were executed.

Of the 70 cases disposed of by Magistrates during the year, 42 were convicted and 28 acquitted, a rather smaller percentage of failure than in the previous year.

Some special rules for the treatment of offences compounded under section 67 of the Forest Act have been framed by the Commissioner in Sind and approved by the Bombay Government As the following extracts show they seem needlessly cumbersome and calculated to result in a good deal of worry all round and nothing else.

"2 Most of the offences detected by Forest Guards having a range of from 4 to 5 square miles to look after are of a trivial character, and the offenders are not too ignorant to know that they are committing an offence

"3 Should, therefore, a Forest Guard under Section 63 of the Forest Act seize a man in the act of committing an offence which, if it falls under 1 (*a*), should be dealt with under Section 67 of the Forest Act by the officer empowered to act under that section on an enquiry held in the manner hereinafter laid down, the following procedure should be observed

(*a*) A person caught in the act of committing an offence should be taken by the Forest Guard to the Wadhero of the deh, and in his presence accuse him of the offence charged Should the offender confess, his confession should be taken down in writing and signed by the Wadhero The offender should then be released, and his confession with a report on the offence should be forwarded by the Forest Guard to the Range Forest Officer. The later, when he next visits the forests, should send for the offender and assemble a panchayat, consisting of not less than three members, who should be men of some standing and influence in the community, and in the presence of this assembly ask the offender if he adheres to his original confession Should the offender adhere to his confession, the panchayat should be asked to certify his having done so. A statement describing the damage done should then be drawn up by the Forest Range Officer, and each member of the panchayat should be asked to sign it. It should be submitted to the Divisional Forest Officer, who will fix the amount of the compensation to be accepted from the offender (which should not exceed Rs 5 in any case), and authorize the Range Forest Officer to accept it

(*b*) In the event of the offender offering to pay the compensation fixed by the Divisional Forest Officer, the money should be paid to him and credited in his account If not, or if he refuses, then the proceedings should be returned by the Range Forest Officer to the Divisional Forest Officer, who, when next inspecting the forest, should make personal enquiries into the matter, and, should he consider the case of sufficient importance may order the offender to be prosecuted before a Magistrate.

"4 Divisional Forest Officers will, however, recollect that it is the desire of Government that trespassers should not be prosecuted for purely trivial offences, such as cutting thorns for a hedge, Unless, therefore, young trees have been lopped or old trees seriously damaged, the Divisional Forest Officer should order a nominal fine, or discharge the offender without punishment.

12 It will be the duty of the Deputy Conservator of Forests (Sind Circle) on his tour to ascertain how these orders have been carried out and the District, Sub-Divisional and Taluka Magistrates should also on their tours make personal enquiry into some of the cases that have been reported in order to see that the proceedings have been regular '

It appears to an outsider rather strange that where there is a Forest Guard to every 4 or 5 square miles of Forest, there should be any people too ignorant to understand what is, and what is not a forest offence The latter part of Rule 3 (*a*) seems wrong in principle Refusal to pay compensation should always be followed by prompt prosecution as therein lies one of the principal safeguards to the proper working of the section Rule 4 looks very nice on paper, but it must be recollected that the Sind Forests are practically nothing but thorns and that the numberless cases of 'cutting them for a hedge do as much damage as fires Rule 12 also which empowers the lowest grade native Magistrate to try and pick holes, in the Divisional Forest Officer's work, must be particularly galling to the latter and we think the Bombay Government would get better work out of their Divisional Forest Officers if they regarded them with less suspicion

The cases in which compensation was accepted were 2024 of which 1867 were cases of illicit grazing and 157 of theft, which latter were compounded for Rs 419

The results of the year s fire protection were that 10,684 acres were burnt out of 4,90,725 acres attempted

"The conditions of the year were decidedly unfavourable and provocative in all Divisions owing to an exceptionally dry season. The river did not commence to rise until late in July, and has not been known to keep so low for the last 30 years The duration of the floods, such as they were, was also very short In such an extremely dry year, following as it did some exceptionally moist ones, the task of fire protection was by no means an easy matter. The reeds and other grasses, having acquired unusual activity in the preceding three or four years, when suddenly deprived of moisture, become highly inflammable and unfit for fodder. The people interested in procuring nutritive crops for their animals in place of rank ones had, therefore, very great inducements to burn the grass tracts."

"All the fires of the year in the Sukkur Division, with hardly an exception, are the result of deliberate incendiarism The following remaks are recorded by the Collector of Shikarpur in forwarding the Divisional report —

"Paragraph 6 Fires within forests call for serious consideration The number of fires has exactly doubled from 44 to 88, while the area burnt is 6,653 against 2,884 acres. Of course, the chief incendiaries are the *maldars* and their object was either to ensure, as is the custom the plentiful growth of young grass from the crowns of the tufts, or a display of retaliation The Collector doubts the wisdom of enhancing grazing fees to prevent this firing of forests by *maldars* This view appears to be borne out even by the Forest Divisional Officer in paragraph 39 where he states several fires occurred after the forest was closed to grazing Affording every facility to neighbouring villagers for grazing and and treating zamindars with consideration thereby enlisting their sympathies and support should be the aim of the Forest Department Let your neighbour be unmolested and he will never be a nuisance is a sound policy to adopt and follow The Forest Department is not liked and is not conciliatory"

"What this conciliatory policy should be the Collector does not expound From my experience of the conditions prevailing in Upper Sind and its people, I fear that nothing short of allowing cattle owners to fire the forests *ad libitum* would conciliate the incendiaries Colonel Mayhew has however supported me and never withheld his consent to enforce either the one or the other of the two punitive measures and on the other hand I have only recommended their application in those cases in which determined opposition was shown and repeated warnings were set at defiance It is but fair to mention that whereas, in the one solitary case noticed by the Collector the closing of the forest to grazing failed to secure the end in view in all the others our efforts proved effective in putting a stop to the mischief'

"The area closed to all animals is only 79 $\frac{119}{40}$ square miles, where—as to browsers it amounts to 167 $\frac{07}{640}$ square miles In this Circle more than in any others that I am acquainted with serious damage is caused to forest growth by herdsmen in charge of camels and goats who lop off branches and young shoots of middle aged trees so that the animals may feed on the leaves or subject the saplings to a rude process by making an incision a few feet above ground in order that the whole crown may come within their reach This form of mischief is very difficult to suppress by ordinary means so long as browsers are admitted into the forests Their depredations have almost denuded extensive areas, chiefly in Upper and Central Sind, and to prevent further destruction from this most injurious practice they have been excluded from a much larger area than ever before whereas against agricultural cattle (oxen and buffaloes, as small an area as it is consistent in the interest of the growing stock was kept closed during the year. The grazing of browsers, especially in localities in which the herdsmen are unruly and turbulent, was further restricted '

The number of cattle impounded during the year under report was 11,569 in open forests, and 17,270 in closed forests, compared with 6,070 and 16,918 respectively in the previous year

Natural reproduction by seed was not good because of the low inundation and the dryness of the season had a bad effect on those lands not usually flooded The only forests benefitted were those subject to deep and prolonged inundation

Artificial reproduction on a large scale is being begun in the Kot Sultan reserve near Shikarpur The plan is the old Sind one of planting tree seeds with cereal crops or others It never succeeded as it ought because the cultivators generally took good care that the land should require another year's cultivation Here the circumstances differ Instead of scattered blanks we are to have a large plantation of the Changamanga style which it is to be hoped may succeed but the Canal Department can kill the plantation at any time on the plea that all the water it can supply is required for agriculture The Forest Department has been robbed to an immense extent by the Irrigation Department Immense areas formerly flooded and covered with dense jungle are now bare and dried up by the system of embankments Water which ought to be claimable as a right cannot be claimed at all, and will not be given if it can be otherwise disposed of The conditions having all been favourable and the soil deep 201 acres were sown with babul and in 16 months have attained a height of 4=9 feet Another 500 acres are being prepared

There has been for many years great jealousy in the Revenue Department and a constant tendency to forbid all cultivation of agricultural crops in forests on the pretext that the revenue from such crops may be made to obscure the actual progress of forest operations Such a pretext will evidently not hold water in these days of endless returns and forms all submitted to the Collector

A good deal of broadcasting was done and the right time is just as the floods are falling, if left too late the seed or seedlings dry up The low flood allowed 10ths of the last years seedlings to perish

In Hyderabad babul reproduces itself from self-sown seed so well, that simple fencing suffices for regeneration Dalbergia Sissoo the only exotic much used for planting Pithecolobium Saman has been tried for the last 20 years there are still half a dozen or so plants to be seen and it is still approved, if any place can be found where it will grow

The black sap which sometimes exudes from babul is stated to be the cause (?result) of a disease (?fungus) called Leuconostoc Two kinds of Polyporus found on babul have been identified by Dr Prain as P lucidus and tomentarius

"The exploitation of major forest produce was based on the following lines —

"Clear or regeneration fellings were applied to all pure or unmixed babul coupes coppice fellings to pure and mixed forests of tamarisks, *kandi* and *bahan* in which babul does not predominate, and the forests of recent formations along the banks of the river were worked on the selection method with a view to exploit small *bahan* timber, such as rafters, posts, &c.

"A rough estimate of the area under each type of forest was made and its exploitable age provisionally fixed, in order to determine the area to be felled over in each block or working circle."

The area for cutting during 1895-96 (October 1st to Sept. 30th) comprises 3928 acres of clear fellings, 22411 acres of coppice, and 5000 acres of selection, or over $\frac{1}{23}$rd of the whole forest area of the province

It appears that some 568 876 animals grazed at full and privileged rates The collection of minor produce goes on as usual.

Timber and produce to the value of Rs 33,416 was given away free and the loss of revenue incurred by the removal of produce at reduced rates was Rs, 5,886.

The following is a summary of the produce removed from the forests :—

Description of material			Number or quantity
Timber	..	C' ft	575,211
Firewood and Charcoal	...	Do	13,731,047
Babul seed	...	Mds	99
Babul bark	. ...	Do.	28
Lac	...	Do	6
Dabh grass	... ...	Do	1,691
Tooth brushes	...	Do.	177
Wheat	... ...	Do.	2
Sar reed	.	Bundles.	187
Kanh grass	...	Do.	2,076
Thorns	... ...	Do.	14,400
Jhau brushwood	...	Do.	6,667

The Revenue and expenditure of the Forest year were as follows :—

Year	Receipts	Expenditure		Total	Surplus.
		Conservancy	Establishment		
1894 95 1895 96	6,79 823 4,65,775	3,15,444 1,28,550	1,02 313 1,06 257	4,17 757 2,34,807	2,62,066 2,30,968
Difference	—2,14,048	—1,86,894	+3 944	—1,82,950	—13,980

VI.-EXTRACTS NOTES AND QUERIES

Kaulia Babul in Berar.

The Inspector-General of Forests has been good enough to send me an extract from the working plan of the Loni Range which, from Dr Schlich's Report of 1883, I gather is situated near Akola giving an account of two varieties of *Acacia arabica.* The same varieties I noticed on a tour through the Berar Forests in March 1877, and will in the first instance give extracts from my diary, as well as a brief account of the specimens collected by me at the that time, and preserved in my herbarium. On my march from Jalámb to Patula on the 5th, I examined several Babul bans in the Akola district near the Purna river. One, the Mattergaon Ban, situated south of the river, between it and the railway, I described in para 177 of my Suggestions, regarding Forest Administration in the Hyderabad Assigned Districts. Regarding another, my diary states as follows: 'On the north side of the Purna examined another Babul ban, on high ground, said to have been formerly cultivated. The trees here were smaller, not more than 12 to 15 ft high, and the Babul was mostly of the variety with deeply cracked and exfoliating bark and broad marginate pods, which has stouter spines than the common kind and is called here 'Kaulia Babul.' It is a decidedly distinct variety, different from the ordinary kind here called Telia Babul, which has regularly moniliform, narrow pods and smooth bark. The third variety of Babul is the cylindrical (commonly called pyramidal) Babul, know here as 'Ram Kanta.' On my march from Patula *via* Hewarkhar to Jiri at the foot of the Melghat hills, the following day, I find in my diary "fine Babul trees of the three kinds on all fields."

The specimens, which I gathered are in fruit, without flowers, and those of the Kaulia Babul certainly have an appearance very different from the ordinary kind. The spines are white, very stout, at the base ⅛ inch diameter and up to 2½ inches long, while the spines of the Telia Babul are brown, slender and only up to 1½ inches long. The fruit is flat, on short stalks very little constricted between the seeds, ¾ inches broad, and quite different from the narrow moniliform pods, on stalks ½ to ¾ inches long, of the Telia Babul, in which the bridges between the seeds often are only ⅙ inches broad.

As regards the bark, it must be remembered that the description recorded by me relates to comparatively young trees, otherwise the bark of the Telia Babul could not have been called smooth. For the bark of old Babul trees has always deep narrow regular longitudinal fissures, joined by short cross cracks. That the bark of young trees of the Kaulia Babul should be deeply cracked and exfoliating ("peeling off" on the specimen ticket) is very remarkable.

So far regarding the observations made by me in 1877. With these observations, the extract from the Working Plan agrees in all points. It contains, however, the following additional remarks: *Telia* has a fairly long bole, smooth bark, small leaflets, the seed ripens in April, grows principally in deep moist soil, and for either timber or fuel is more valued than *Kauria*. *Kauria* (evidently the same as Kaulia) has a shorter bole, very deeply furrowed bark, the seed ripens in January and February. The Loni Range is south of the Purna river situated, I suppose, some 18 miles east of the Babul Ban visited by me on 5th March 1877. Clearly, therefore, the Kauria Babul extends over a considerable portion of the Berar valley.

The value of the Babul tree, which yields fuel, timber, tanning material, gum, lac and cattle fodder, which thrives in the dry climate of the Deccan as well as in the North-West, and which seeds profusely, is easily propagated and coppices readily, is so great and so universally recognized in India, that no apology seems needed for drawing prominent attention to the variations which it presents. The readers of the "Forester" will, I feel assured, not take it amiss if I offer a few suggestions for the further study of this subject. It seems to me to be a matter of importance to make a special study of the Kaulia Babul, which may possibly turn out to be a hybrid or a distinct species. The principal Babul forests, pure or mixed with other trees, are found in Sind, in the river valleys of Berar and the Northern Deccan on the black cotton soils of Bellary, Anantapur and Kistna, also in Guzerat and in Rajputana on fields near villages and on waste land; the tree is however found in most provinces, but disappears when we reach the more humid regions near the coast, and the extreme North beyond the Jhelum, where frost is too severe.

The first point to be ascertained is whether Kaulia Babul is found anywhere else, or is limited to Berar. The second point is to establish the distinctive characters of Kaulia more completely than has yet been done.

The leaflets are said to be smaller, and this is borne out by the specimens collected by me in 1877. But there are many other points to be noted, the length of the common petiole, the number of pinnæ, the glands at the base of those, and the average number of leaflets on each pinna. There may also be differences in the inflorescence, in the flowers and in the seed, as well as in the structure of the wood. The time of flowering of both kinds should be noted more completely than has yet been done. With regard to the statement in the Loni Working Plan, I would observe that on the 5th March the pods of both kinds were not ripe yet, and apparently they were in the same stage towards ripening. The seedlings of both kinds in their course of development should further be examined and described, and it should be ascertained at what age the tree begins to flower what size Kaulia attains, and whether it coppices as well as the common kind. Lastly the value of the Kaulia bark as well as of the gum should be determined and it should be ascertained whether the pods are also useful as cattle fodder. Attention should likewise be paid to other species of *Acacia* growing in company with Kaulia Babul. In the Ban north of the Purna river, where I found it on 5th March, 1877, my diary mentions *Acacia eburnea* and *Jacquemonti*. The thought has struck me, whether Kaulia Babul might not possibly be a hybrid between *Acacia arabica* and *eburnea*. The latter has stout, often ivory, white spines, and small leaflets. The pods are flat slightly contracted between the seed but only ¼ inch broad. In the Babul bans of the Poona district near the Bhima river *Acacia eburnea* also grows in company with *arabica*, but I find no mention of forms similar to Kaulia Babul in my diary. I would venture to draw the special attention of Foresters in Berar and in the Deccan to this question.

Should these remarks find favour with any reader of the "Forester" in Berar or elsewhere where Kaulia Babul grows I will add in conclusion, that I should be most thankful for complete specimens with flower and nearly ripe fruit as well as seedling dried at different stages, ripe seed, and small pieces of the wood.

BONN, JULY. 1897. D. BRANDIS.

The advances made in Agricultural Chemistry during the last twenty-five years.

An important address has been recently delivered by Professor Maercker, of Halle to the German Chemical Society (Ber. 1897, p. 464), summarising the advances which have been made in agricultural chemistry during the last twenty-five years. Professor Maercker pointed out that the term Agricultural Chemistry meant more at the present time than the mere application of chemistry to agriculture, as shown by the fact that the agricultural chemist, in his efforts to assist the farmer, was often more concerned with the biological sciences than with chemistry; while, in addition to his purely scientific work, he was required to take account of economic questions of the day possessing special interest to agriculturists. Some account of the most important parts of the address will be given under the following heads:—I. Plant-food; II. Soils and Manures; III. Artificial Selection.

I. PLANT-FOOD.

In supplying nourishment to plants we must know what substances are necessary, and in what form and quantity they should be provided. Little progress was made in our knowledge of the subject till the quite recent introduction of the method of water-cultures of Sachs Knoop and Nobbe, and the method of sand-cultures of Hellriegel permitted of the conduct of experiments in pure media, and thus rendered it possible to ascertain not only what substances are essential for plant life but also the part played by each substance in the plant cell Thus we know now that phosphoric acid is essential for the formation of nitrogenous substances in the plant because the albumens which are of fundamental importance in the transformations of substances in plants, result from an intermediate phosphoric acid compound as is indicated by the regular occurrence of lecithin in protoplasm Again iron is an essential constituent of chlorophyll and sulphur of albumen, and hence must be supplied to plants The true function of calcium was for long doubtful its action is now known to be of a medicinal character, since it serves to neutralize the poisonous oxalic acid, which is always an intermediate product of the oxidation of the carbohydrates It was formerly thought that calcium fulfilled some important function in the leaves being chiefly found in the foliage of plants Since, however the leaves are also the chief seat of the oxalic acid this distribution of the calcium is easily explained

The part played by potassium has only within the last three years been explained by Hellriegel, who by exact experiments with beet-root showed that the amount of sugar in the beet stands in close relation to the amount of potassium provided for the plant P Wagner has made the interesting observation that the potassium may be *partly* replaced by sodium

The exact value of magnesium to plants is not yet well understood, but it appears to be of importance in the formation of the nitrogenous substances of seeds, as in these considerable quantities of magnesium phosphate occur

Nitrogen is an indispensable plant-food, for it is an essential constituent of albumen,

* In addition to the quantities of mineral substances required by plants to enable them to exhibit a healthy growth, further quantities are found to be essential to satisfy what has been termed, though not very aptly, the "*mineral-hunger*" of the plant This is best explained by an example E Wolff found that for the production of 100 parts of oat-plant (dried), 5 parts of phosphoric acid were necessary, when the remaining mineral substances were supplied in excess to the plant By other similar experiments he showed that the following quantities of mineral substances were necessary for the production of 100 parts of oat-plants

Phosphoric acid	50	parts
Potash	80	,,
Lime	25	,,
Magnesia	20	,,
Sulphuric acid	20	,,
	1 95	parts

A total of 1.95 parts of mineral substances is therefore *necessary* in the case of the oat-plant. However, there is no oat-plant in nature which contains so little as 1.95 per cent. The minimum is 3 per cent. The difference 1.05 per cent is the measure of the "mineral hunger" of the plant and represents the mineral substance which does not perform any special function. This excess of mineral substance may be supplied in the form of some indifferent substance, such as silica. The observation is of considerable interest to the former for it shows that it is not economical to manure crops with pure substances.

II. SOILS AND MANURES

Having ascertained in general what substances are necessary as plant food the agricultural chemist has next to apply this general information to the manuring of soils which are more or less deficient in certain ingredients. It has been found unfortunately, that the chemical analysis of a soil is of little use as a guide unless accompanied by what may be termed a "mechanical analysis," by which is meant chiefly a determination of the amount of finely divided constituents present in the soil. It is only the finely-divided earth which presents a sufficiently large surface for the exercise of the solvent action of the water and its dissolved carbonic acid. There is one case however in which chemical analysis alone is of the greatest importance, *viz.*, when only traces of some necessary element are present in a soil. Here there is no question of the need for a manure containing this substance.

If on the other hand large quantities of an element are present it does not follow that there is a sufficiency in the soil even when the latter is in a satisfactory state of division for the substance in question may be present in an insoluble or refractory form. This is commonly the case with nitrogen which exists in the soil chiefly in the form of a mixture of indefinite nitrogenous substances known as *humus*, or mould. These substances sometimes easily give up their nitrogen to plants, but in other cases are very refractory. The uncertainty as to their action is indeed so great that certain peaty soils are known which consist almost entirely of humus, but contain nevertheless an insufficiency of available nitrogen.

Phosphoric acid affords another illustration. The soluble phosphoric acid of the manure is absorbed by the soil as dicalcic phosphate, which is comparatively easily soluble in the soil water. With time, however it may change in the soil to the insoluble tricalcium phosphate or even to iron or aluminium phosphates which are still less soluble.

In the case of calcium chemical analysis has been found to be of considerable service in determining what manuring is required, since calcium is chiefly valuable in the form of carbonate or humate, and these are easily estimated in the soil.

Since then the direct method of soil-analysis is an insufficient guide to manuring it is fortunate that chemists have been able to develop successfully an indirect method. This is the *cultivation method*, by which plants are allowed to grow in the soil under examination, after taking care to provide a sufficiency of all plant-food stuffs except the one, *e g* phosphoric acid, whose presence in available form is being tested. The plants are then analysed, and the results compared with the analyses of the same plants grown on soils provided with all the necessary plant-food stuffs. As an important result of the method it has been found that different plants take up very different quantities of the same mineral substances On this is largely based the system of rotation of crop where the second crop is so chosen that it chiefly removes the ingredients of the soil which have been left by the preceding crops.

With the aid of the cultivation method it has also been possible to draw up the following table which represents the relative value, of the different nitrogen compounds for plant-food.

Nitrogen of Saltpetre .	100
,, ,, Ammonia .. .	85-90
,, ,, Albumen	60

This table may be made use of in determining the nitrogen value of a manure

The cultivation method may be used for testing the value of manures of all kinds Thus it was by a few cultivation experiments that Wagner in Darmstadt first showed the very great value for agriculturel purposes of the "Thomas" Slag produced as a bye-product in the manufacture of iron by the basic process of Thomas-Gilchrist The million tons of phosphate meal annually produced in Germany is now wholly utilised by the agriculturist and its preparation for the farmer has become an important off-shoot of the iron industry.

Similarly the demonstration by the cultivation method of the value of potash salts in manures has given an enormous impetus to the potash industry.

Speaking generally, the method gives us complete control over the fertility of a soil in so far as this depends on manuring One consequence of this has been that our views as to the value of agricultural land have completely changed, for whereas formerly sandy soils were generally considered poor, they are now, by means of a system of intelligently-directed manuring, made to give yields which are scarcely inferior to those of the best soils The beet-sugar industry, which formerly could only be conducted in the best soils, has now been extended with marked success to sandy soils

It might seem that with a perfect knowledge of the manuring of plants, the need for furthur investigation would cease, for when we have learned easily what each plant requires to attain its highest development we have reached a certain limit The supply of excessive nourishment is a disadvantage, and only tends to produce sick plants.

There still remains, however, a method by which the fertility of plants may be increased far beyond the limit which nature appears to have fixed. This is the method of artificial selection which has been applied in Germany on the most approved scientific principles. German agriculture would have long since broken down under the stress of foreign competition had it not been for the perfect technology of its agriculturists. As an example, the sugar beet may be quoted. This plant which is derived from the white Silesian turnip and contained originally but a small amount of sugar could only be used as a source of sugar when the price of the latter was very high. With the fall in price came the urgent need for increasing the percentage of sugar in the beet root. This was effected by utilising the fact that sugariness is hereditary, so that by selecting artificially the roots richest in sugar, getting seed from these, planting the seed, again selecting the richest roots and so on, a race of plants is at length obtained in which a high percentage of sugar is normal. Accordingly the producers of beet-root seed in Germany have erected great laboratories in which the percentage of sugar in the roots is carefully determined. By applying the principle of artificial selection with regard also to the form and size of leaf and the purity of the sap, it has been found possible to improve the roots from year to year, so that now beet sugar can easily hold its own against cane sugar, and is indeed cheaper than flour, costing as it does in Germany less than a penny a pound.

Similar success has attended the efforts to increase the crops of different kinds of grain. The improvement in malt-barley has been specially marked.

It has been found that plants which have been highly cultivated by artificial selection easily lose their acquired characters when they are exposed to unfavourable conditions of cultivation, and this has led to many exact investigations conducted for the most part in Germany, during the last ten years on the chemistry of plants. The most interesting of these trace the chemical history of nitrogen as it passes from the atmosphere to the soil, then into the substance of plants and finally back into the atmosphere.

The corresponding cycle for carbon has long been known.

Most plants assimilate nitrogen only in the form of compounds. As, however, the total quantity of nitrogen compounds in the atmosphere is comparatively small there must be some other source of nitrogen for plants. Now the classical researches of Hellriegel have shewn that there is one class of plants, the *Leguminosæ* or nitrogen collectors, which are able to assimilate elementary nitrogen and so to leave a soil in which they have been grown richer in nitrogen compounds. It has been found that the power of acting as nitrogen collectors is always associated with the presence of micro-organisms on the roots, and that the assimilation of the nitrogen is in some way not understood due to the micro-organisms. The recognition of the power of leguminous plants to act as nitrogen collectors is manifestly of great practical importance, for it shows clearly that the best rotation of crops is one in which a leguminous crop is followed by one of nitrogen consumers, *i. e.* plants which cannot assimilate nitrogen directly.

Leguminous plants, whether first used for fodder for animals or simply left to decay in the soil have their albumen changed in the first instance to amides which under the influence of ammonia ferments are decomposed with formation of ammonium-carbonate. The saltpetre bacillus then converts the ammonium-carbonate (and probably also amides) into saltpetre, *i. e.* into the best form of nitrogen plant-food.

Unfortunately the whole of the nitrate thus formed is never available for plants on account of the destructive action of the nitrate—destroying bacilli which decompose the nitrates with evolution of free nitrogen, and so complete the nitrogen cycle.

The nitrate destroyers are usually present in stable manure, and cause a deplorable loss to agriculture amounting in Germany to a sum of several million pounds annually.

Efforts which as Professor Maercker assured the German Chemical Society are likely to meet with success at an early date, are being made to avoid this loss, and for this purpose special bacteriological investigations are now being conducted at many agricultural stations in Germany.

Imperial Institute Journal.

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

5th August, 1897.

EAST INDIA TEAK.—The deliveries for the first seven months of 1897 are 10,713 loads as compared with 12,070 loads for the first seven seven months of 1896. For July this year the figures are 1,356 loads against 1,609 loads in July 1896. There have been signs of a slightly better demand for floating cargoes, and some sales have been effected. The stock in London is still excessive, and is largely made up of inferior wood, the demand for which has been listless during the month.

ROSEWOOD.—EAST INDIA.—Is asked for, and small lots of good logs would sell well.

SATINWOOD.—EAST INDIA.—The demand has fallen off and stocks are sufficient.

EBONY.—EAST INDIA.—Good wood in small lots, commands fair prices.

PRICE CURRENT.

Indian teak	per load	£10	10s	to	£15 10s.
Rosewood	„ ton	£8		to	£10
Satinwood	„ sup. foot	6d		to	12d
Ebony	ton	£7		to	£8

MARKET RATES OF PRODUCE.

Tropical Agriculturist, August, 1897.

Cardamoms		per lb	[illegible]	to	3s 1d.
Croton seeds		per cwt	75s		
Cutch		„	9s 3d	to	32s. 6d.
Gum Arabic, Madras		per ton	35s	to	40s
Gum Kino	„		£15	to	£55
Indiarubber,	Assam	per lb	1s 9d	to	2s 4d
„	Burma	„	1s 4d	to	2s 1d.
Myrabolams,	Bombay	per cwt	4s 3d	to	9s.
„	Jubbulpore	„	4s	to	7s.
„	Godavari	„	3s 9d.	to	5s 6d.
„	Calcutta	„	3s 6d.	to	5s. 6d.
Nux Vomica, Good		„	7s	to	7s 6d.
Oil, Lemon Grass		per lb	2⅜d		
Orchella, Ceylon		per cwt	10s.	to	12s. 6d
Sandalwood, logs		per ton.	£30	to	£50
„	chips	„	£4	to	£8.
Sapanwood,		„	£4.	to	£5.
Seed lac		per cwt.	70s.	to	80s.
Tamarinds		„	7s.	to	8s. 6d.

Teak Circular.

DENNY, MOTT, AND DICKSON report:—1,748 loads of logs and 581 loads of planks were landed in the London Docks during last month, against 816 loads of logs and 471 loads of planks delivered into consumption. The present Dock stocks analyse as follows.—

	1897		1896
	lds		lds
	9,114	logs	7,516
	2,152	planks	2,857
	24	blocks	109
Total	11,290	loads	10,482

Last month's teak imports consisted entirely of parcels ex-steamers, and were composed largely of the inferior wood which has been for some time diverted by speculators from the Indian and Chinese markets to Europe. Such wood, whilst it can be economically used in the East for general domestic purposes, is quite unfitted for the high-class shipbuilding and rolling-stock work, for which it is principally specified in Europe; and consumers are stinting their teak purchases rather than be forced into buying a low grade of quality and conversion which they know to be unsuitable for first-class work. The supply of first-class wood continues to be very small; but should the new season's supplies from the forests permit of larger imports of good merchantable quality, the speculative hope of creating a market on this side for inferior wood will disappear; and if such wood has proved to be difficult to sell in a time of short supplies, it will certainly find no market when the present abnormal scarcity of first-class wood has passed away. Meanwhile, good wood maintains a large premium in price as compared with second-class wood, and consumption is largely of a "hand-to-mouth" nature, especially now that the engineering strike is gravely affecting shipbuilders

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India Rubber.

In an article on India Rubber in the "Indian Agriculturist" of the 1st September, we notice an extract from a paper by Mr J R. Jackson, which appeared in 'Nature," Vol 55, page 610 Except where this paper may be taken to refer to the few artificial plantations that have been established, it is, we regret to say far from accurate, for it talks of the *Ficus elastica* forming large forests in India and Ceylon, while, as far as our Indian experience goes, we only find this species very sparingly interspersed in evergreen forests The *Ficus elastica* is not sufficiently shade-enduring to permit of its germination and growth on the ground The seed no doubt germinates very freely in the forks of trees where a little mould or *débris* has accumulated, but in order to permit the young plant to establish itself and to become sufficiently strong to form a connection with the soil below it is absolutely necessary that the tree on which it finds itself placed should be either dead or diseased. If not the young *Ficus* cannot obtain sufficient nourishment, and dies That this is the case has been clearly established by experiments in the Charluar rubber plantations Here many hundreds of *Ficus* were planted in the forks of trees They were supplied with a considerable quantity of soil and grew to be healthy plants; but they lived the life of pot plants, and after more than 10 years not one of those growing on a healthy tree had established its connection with the soil Now, even in a virgin evergreen forest, the majority of trees are neither dead nor so unhealthy as to yield sufficient nourishment to the *Ficus elastica* till it has become connected with the soil and established itself as an independent tree; and the "veritable forest of trunks" remains a thing to be wished for, but does not exist in nature.

As regards an entirely artificial rubber plantation, Mr. Jackson's description is perfect. In fact over acres of such plantations the roots of the trees, in some instances planted 100 feet apart, have not merely become interlaced but have amalgamated, and acres and acres may be said to live, so to say, on one great root.

Kumri Teak Plantations.

In hopes that this method of regeneration in our Indian forests may interest some of the readers of the "Indian Forester," I venture to give the few following notes of what we have been doing in Coorg during the last few years. I do not think I am far wrong in saying that Coorg is the first place in India where "kumri" is being made use of on a large scale in the growing of teak and lately of teak and sandal together. It is needless for me to go into details as to what "kumri" is, as no doubt all foresters are well acquainted with the "taungya" of Burma, and Kumri is only another name for it. Kumri teak plantations were first started in Coorg in the rains of 1891 on a small scale when an area of about 17 acres was planted out with teak in the Mawkal Reserved Forest. Since then this system of planting out teak has been extended to other forest blocks and has now reached 393 acres.

KURAMBA FOREST VILLAGERS.

The "kumri" clearings are made by Kurambas, an aboriginal tribe who love nothing better than this method of cultivation, and ever since the 'kumri' has been started I have found them coming to our forests in fair numbers and forming small "hadis" the local name for a collection of Kuramba huts. It can hardly be called a village as a Kuramba is not fond of encumberances and enjoys the freedom of being able to shift at a moment's notice. He is by nature very lazy and hard work does not suit him for long, so that he requires most gentle handling, but on the whole his services are invaluable to the forests in Coorg, where his is the sole labour that can in any way be depended on. Now that he and his family have taken kindly to the planting of teak in his Kumri, every encouragement is given him to settle in regular selected sites within the forests. There is always the danger owing to petty annoyances from the forest establishment, of a batch of these men leaving the forest, for this method of planting is not in favour with some of the subordinates who would much like to see it stopped and the old system of planting taken up again, the results of which were not satisfactory and the expenditure high. The Kuramba's only regular crop is "Ragi" "*Eleusine corocana.*" For this he prepares the ground by cutting all forest growth in the area selected for him. This is done in January, after he has helped to clear the firelines of the forest within which his "hadi" is located. In April or May, according to it being a dry season or not he sets fire to the area after carefully making a fire trace round it. This occupies him, to do it properly, from 8 to 10 days, allowing for cutting and heaping up stuff not properly burnt. The land is then quite ready for sowing, but before the sowing he and his family carefully stake out the area, where the young teak plants are to be put out later on each man doing his own plot. After one or two monsoon showers, early in June, the Ragi crop is sown broadcast, the ground having been first slightly worked up by a light hand hoe As soon as the crop is sown the young teak plants which have been raised in a nursery made by the Kurambas themselves, are put out at stake by the men, women, and children

TEAK NURSERIES

These teak nurseries are made by the Kurambas close to their "hadis" The seed is collected departmentally and given to the men early in February A small area is then well worked up by them near water and the seed sown thickly in the prepared bed a coating of straw is placed over it, and the whole kept well watered by the women and children Each house has its separate little plot in the nursery by mutual arrangement It is astonishing how kindly these men have taken to this part of the work, considering the short time they have been at it I have never found the nurseries neglected and they are always kept well watered The seed put out in February and March begins to sprout by the middle of April and May, and by the time the young plants are put out during the latter part of June, the seedlings are from 3 to 4 inches high and some even 6 inches and more.

KUMRI TEAK PLANTATIONS

When the crop has been sown and the young plants are all in place with the rain coming down as it well knows how to in Coorg, the men of the 'hadi' are most of them engaged in the coupe fellings, for nearly all our forests here are under working plans But it must not be understood that because the men are away, that the area on which the crop is sown and the teak planted goes untended, far from it, the women and children are seeing to this The first weeding begins about the last week in July and is kept steadily going right through to the flowering of the Ragi, and it is no easy task to keep down the weeds There are other difficulties to be contended against, which if neglected for a single night are almost sure to ruin the whole field All the forests where the Kurambas have taken so kindly to the work are overrun with herds of wild elephants, and notwithstanding the numbers caught by the Mysore Kheddas from the adjoining forests the elephants are still found in fair numbers Deer also are very destructive in these quiet secluded forest clearings, so that the Kurambas have by no means an easy time of it, and are bound to keep both a night and day watch over their crops As the area of Kumri goes on extending the men, still retaining their "hadis," build for themselves each near his own plot, nice little shelters where they live for the four or five months during the time the crop is down and uncut.

PAYMENT FOR PLANTS RAISED.

As noted above, the current year's teak plants put out get well weeded with the weeding of the crop These plants are not paid for during that year, and are still under the care of the Kurambas who planted them till August of the following year, when they get a final weeding and are counted and paid for at the rate of Rs 1-4 0 per 100 plants on the ground That is, the young seedlings get the benefit of a two years' weeding besides the raising and planting, for Rs 1-4-0 per 100 plants alive This, if I am not mistaken, is a more favourable arrangement than that of Burma, where the plants are counted and paid for at the end of the first rains. I may be mistaken, as I have not seen any paper on Burma taungya. However, the arrangement is a most satisfactory one for a small place like Coorg where labour is so very expensive, owing to the numerous coffee estates adjoining

The teak plants are put out at a distance of about 6 ft by 9 ft and it may be argued that this distance is much too close but allowing for a certain amount of failures, I would not advocate, at least for the present, the planting to be farther apart The number of plants raised per acre and paid for has been from 600 to 800 and the Rs 7-8-0 to Rs 10 hitherto paid must be considered moderate Of course it is needless for me to mention that the Kurambas get the crops raised on the area free of any assessment

To stimulate a certain amount of competition among the men, I have introduced during the last three years a small prize for the man showing the best results during the year of payment, which has I am happy to say, taken most favourably, and by this means the second year's weeding before the payments are made, has received great attention, with very good results

WEEDING

I have given above the life history of these teak plants for the first two years It must not be inferred from this that the idea is to convert the whole area into pure teak forests, which for Coorg would be a mistake During the second year's weeding such stool shoots of Terminalia, Dalbergia latifolia, Pterocarpus, Lagerstroemia microcarpa and one or two of the other good forest trees are not cut back, and such seedlings of the above species as may have sprung up are also left. While on this point, I should like to mention a fact in connection with Dalbergia latifolia, and that is its great vitality in not only sending up stool shoots, no matter what the size of the tree may have been, and the abundance of root shoots that spring up right round the parent stools in these burnt areas

After the second weeding the teak plants have to be tended departmentally, and weedings have, over a good part of the area, to be done most carefully for at least another 3 years. Bamboos

(Bambusa arundinacea), inferior species such as Kydia, Sponia, climbers and the ever spreading lantana have sprung from the old clumps and stools and shoot ahead It may be asked, why lantana is mentioned here , simply because though generally a shrub, it has when it gets a young tree handy, a nasty habit of becoming a regular climber and will in time choke out its support, as it spreads most luxuriantly over the branches, and forms a most dense crown over the saplings. All these have most carefully to be kept down in the Kumri plantations until the teak has made some headway and got a fair start An average of Rs 2 per acre yearly is sufficient for this work for the three years, and then the teak in Coorg is left alone.

RESULTS OBTAINED

The Kumri plantations have up to the present been solely confined to the Reserved Forests along the eastern border of Coorg, adjoining the Mysore country, and have steadily been increased since 1891, each year showing a larger area worked And as parties of Kurambas keep coming in with their families and are being located in fresh forest blocks the work is satisfactorily progressing The area of plantations has now reached 393 acres, which considering the difficulties that had to be encountered is very good The results of the planting are also all that can be desired I have measured a number of saplings and obtained an average for plants put out in 1891 of 6 inches girth at 5 ft from ground and 15 feet in height I have also in this same area measured a number of saplings 12 inches girth and 20 feet in height These measurements speak for themselves, the growth being that of 6 years I expect even better general results from the Kumri plantations taken up since 1895, the young plants having an average girth for the two years of 2½ inches at 1 foot from the ground and 6 feet in height, some of the largest measuring 4 inches in girth and 10 ft in height With these figures before one, it can hardly be questioned that the results are not a success with a minimum of cost

I have stated above that kumri has hitherto been confined to the eastern zone of the Coorg forests In the Nalkeri forest where the rainfall is 66 inches, 241 acres are under Kumri plantations In the Mawkal Forest the rainfall is 45 inches, and 130 acres are under " Kumri, while in the Dubare forest still farther north, were the rainfall is only 36 inches, and where Kumri was started only last year, the area is 22 acres

In the Ghat Forest to the west when the rainfall varies from 120 to 145 inches, a Kumri plantation has been started through the kind help of one of the planters, who has a cardamom estate adjoining the forest, and Kurambas who have no work during the greater part of the rains have taken this up for me. I am very hopeful of success here also.

SANDAL AND TEAK KUMRI PLANTATIONS.

Having, during the last three years seen that teak succeeded so well in Kumri, I started a small area of Kumri plantation in which I got the Kurambas to dibble in sandal seed along with "togri," *Cajanus indicus*, in lines 10 feet apart, with "ragi" sown in between the lines The sandal was kept well weeded right through last rains, while the "togri" helped to protect the young sandal seedlings through the dry weather The results I might say, when seen by me the other day, are marvellous for sandal The plants average 1 inch girth at 1 foot from the ground and have an average height of 3 ft 6 in, the largest running to 1½ inches in girth and 6 ft 6 in in height This I considered good enough to permit of my going in for sandal kumri plantations on a larger scale, so I have combined it with teak on 17 acres in the Dubare Forest The teak is put out about 7 feet apart in lines about 15 feet apart, and a line of sandal dibbled in between the two lines of teak, which gives alternate lines of teak and sandal I have seen sandal under teak and it does very well. Another great advantage will be the protection of the young sandal plants from being eaten up by deer, besides having the benefit of two years' weeding When last seen these 17 acres of sandal and teak kumri plantations right in the depths of the forest with the little kuramba huts dotted about, were a most pleasing sight. I took the opportunity of counting the teak plants put out at the beginning of the rains on the 17 acres, and they amounted to 500 good strong plants per acre so that even if the sandal is not a success, of which I have no fear, there will be a sufficient number of teak plants on the area

GENERAL FACTS NOTICED

Before closing these notes I would mention that nearly all the young teak seedlings put out during the first rains die down in the hot weather, only to throw up a vigorous shoot during the next rains This is more noticeable in the larger plants put out, those of 6 inches in height and over.

Another fact in connection with teak plantations deserving of careful note in Coorg, is that all teak saplings after they have attained a height of over 15 feet have their side branches attacked with canker, which as the tree keeps on growing, invariably kills out the branches Fortunately in no single instance do I recollect to have seen the leading shoot thus attacked. The disease is most prevalent in our old regular plantations where every tree is covered with cracked knobs on the branches which are dead and dying I have mentioned this fact, because I see that the disease has made its appearance in the teak Kumri plantations of 1891 and 1892 What effect it will have on the growth of the teak later on remains to be seen and will be carefully watched.

A. E. LOWRIE.

II.—CORRESPONDENCE.

The after-training of Cooper's Hill Men.

It has been the custom for many years past to send the new arrivals from Coopers Hill, straight to the Provinces where they are going to serve and after a short period which may vary from a few weeks to a few months, they are generally put on some special work, as often as not they are attached to a working plans party. When they arrive in India they admittedly possess a certain amount of theoretical knowledge which has been crammed into them in spite of, sometimes a dislike for the subject, but there are certain practical questions connected with Indian forestry which can only be learned in the country itself.

As matters stand at present these recruits are scattered broadcast over the country stationed in diverse climates amidst a variety of tongues to work in anything varying from scrub forest to dense evergreen never to receive any idea of forestry in India as a whole, but to settle down in some special groove carved out for them by the condition of their environment In some provinces owing to the oft recurring scarcity of officers they may be after a short time pitchforked into the charge of a division without any previous training in office work or accounts—for the examination they have to pass called Procedure and Accounts is a mere farce, it is all cram from beginning to end—unable to compose or indite an official letter, and the work has to depend for its efficiency on the head clerk

Many of those who are sent direct to Burma and Assam never get a chance of seeing fire conservancy learning how a fire line is made and cleared which may be all very well as long as they remain in a damp climate with dense evergreen forest ; but suppose they are transferred to Goalpara, or the dry zone in Burma, and are called upon to protect their forests Is it fair to them to expect much when they have been taught nothing in this special line and have never been given a chance of learning ?

It is my deliberate opinion founded on some experience of different provinces and several years' knowledge of the subject, that it would be infinitely preferable to send the whole batch of Coopers Hill men, for their first year in India, to the Forest School at Dehra Dun. Whether they should spend the third year at Coopers Hill as they do now or leave that institution at the end of the second year, is a question that I cannot enter into at the present moment, though I hold strong views on the subject The point of these remarks is that the recruits should pass their first year in India at Dehra Doon, be it the third or fourth year since they entered at Coopers Hill.

It may be asked what could they learn there which they had not already been taught at Coopers Hill? Much—very much—and I will prove it Not considering for the moment the relative importance of the subjects, I will take them in any order as they happen to come

Firstly—they would learn Hindustani a language which is distinctly useful in whatever province of India they may eventually be posted to a language which is of great use to a Forest officer even in Upper Burma, Assam, or the wilds of Kanara

Secondly—arriving in November they would at once begin camp life and would be practically taught various Forest operations, chief among which would be Fire Conservancy On the southern side of the Siwaliks they would learn how a fire line is made, cleared and burnt, in a country with high grass and strong winds

Later on in the Dun they would again be shewn the same thing in a damper climate and in a country with denser and more valuable forests These operations they would carry out with their own hands At the same time they would be learning the characteristics of one of the most important trees in India, the Sal, they would see the marvellous effects of continued and successful fire protection on its reproduction Besides numerous other forest operations too numerous to mention here but of incalculable benefit to them afterwards, they would learn what camp-life is like and how to shift for themselves in the jungle They would learn how to distinguish and identify some of the most common Forest trees in India and thus there would be less chance of seeing what is common now, a Forest officer of several years' standing utterly ignorant botanically of the forest flora of his division and not able to recognize one tree from another, except a few of the more important ones It is not unlikely that this training at Dehra would imbue them with a special interest in their forests and its contents

Thirdly, they would see and study various working plans in progress, and would make the acquaintance of the code forms used in connection therewith Later on in the season they would visit the pine and oak forests of the Jaunsar Division, and learn the characteristics of another of India's most important trees, the Deodar They would see timber and fuel works on a large scale, would learn how hill roads are made, ravines crossed, and bridges built, besides many other instructive matters which we have not space to mention here

Lastly, not to dwell on this part of the subject too long, they would in the rains (or during a portion of them) be thoroughly taught Divisional accounts, the preparation of an annual report, and the Budget Estimates

After 12 months of this varied and thoroughly practical training, in an excellent climate amidst pleasant surroundings, they would depart to their respective provinces far better equipped for their Indian career than they can possibly be under the present system. The great cry of all provinces is paucity of officers, hence the eagerness with which they seize on the new Coopers Hill arrival even in his raw state. But after undergoing such a course as has been briefly sketched above, the officer would be far more valuable to his province, whichever it might be, and the sum expended on his pay and allowances, amounting perhaps to Rs 4,000 or Rs 5,000, would return soon to the Local Government or Administration in highly increased efficiency, and a more advanced degree of usefulness at the outset.

It is not the fault of Coopers Hill that such a state of affairs should exist—initial ignorance of the most elementary factors of Indian forest work. This can only be picked up in India itself, and the only place where it can be economically, rapidly, and efficiently taught, is the Forest School at Debra Dun.

I happen to know that several officers of long standing in this country are of the same opinion as myself, and it appears to me that the subject is well worthy of further discussion in the pages of the 'Indian Forester,' whereby perchance it may eventually be brought to the notice of higher authorities.

SCRUTATOR.

The Gurnand System.

Will you kindly permit me me to make a few remarks on some papers by Mr Fernandez which have recently appeared in the Appendix Series of your Journal.

I. *The so called Méthode du controle, or the Gurnand System of High Forest and of Coppice Treatment.* Fixing the relative proportion of the diameter classes for the trees forming the stock in a forest worked by jardinage seems to have much to recommend it, and it would be as well if an attempt were made to do this in our selection-treated Indian forests. I must however, demur to M Gurnand's method of carrying out this idea. Mr Fernandez gives no explanation of the reasons which led to the formation of Gurnand's four diameter classes. These differ from each other in a most irregular manner, whether from the point of view of girth, cubic contents, or age. Why, for example, should class II (from 26 to 35 centimetres) have a diameter range of 15 centimetres only, whilst class III (35 60 centimetres) has a range of 25 centimetres? Again, how does M. Gurnand justify the relative proportion which the stem contents of classes II, III and IV should bear to each other being fixed at 2 : 3 · 5? It seems to me that the stems of class III will be found wholly inadequate to recruit class IV.

Let us take a concrete example . at page 20 of Mr Fernandez' article we find that in the experimental area under treatment the average outturn per tree exploited was : –

II	class	0 3	c m
III	,,	1 0	,,
IV	,,	2 2	,,

Applying these factors to Mr Fernandez' table at page 12 we have

Age classes on separate areas of 1 hecture each		Ages intermixed as in Gurnand's system	
Classes	No of trees	Diameter Class	No. of trees.
45 classes 1-45 years old	...	I	.
33 ,, 46-78 ,,	81,520	II	64 230
71 ,, 79-149 ,	79,873	III	43,479
1 ,, 150	593	IV	38,556

Suppose that 75 per cent of the III class (a very liberal allowance) become IV class within the average time then in 71 years 59,906 trees or 843 per annum enter the IV class under the regular system compared with 32 609 trees or 459 only per annum under the Gurnand method, therefore the latter method is to the bad by over 80 per cent The impossibility of maintaining such an overwhelming proportion of IV class trees seems therefore very plain In a natural forest where the annual yield has been regularly worked up to and where the forest is not deteriorating, we always find the lower classes much more numerous than the higher and this is nature's way in every phase of life It is true that nature in her care for the preservation of the type, is prodigal as regards reproduction By intense management the forester can doubtless dispense with a portion of such reproduction, but never to anything approaching the extent advocated by M Gurnand if Mr. Fernandez' exposition of that officer's views be correct

In the Naini Tal and Ranikhet chir forests the enumeration shows :—

	Relative proportion of stems.	
	Naini Tal	Ranikhet.
I class over 2 diameter ...	1	1
II ,, 1½' to 2' ,, ..	4	4
III ,, 1—1½' ,, .	11	8

The Chir in Bndlakot compartments 7-10, comprising 320 acres and 10,000 trees were counted by Mr Fernandez when preparing his working plan for Naini Tal and re-counted by me 15 years afterwards, no fellings having taken place in the interval. The results are as under —

	Compartment		
	9	9 and 10	7 to 10
Percentage of II class chir entering I class in 15 years	11	10	11
„ III „ II „ „	17	19	18
„ IV , III „ „	15	22	20 5

The different countings thus give very similar results and point to the accuracy of this method of estimating the stock The only great difference is in the percentage of IV class trees entering the III class This was to be expected it being but natural that the number of suppressed trees in the IV class should vary considerably with the density of the young pole forest According to Mr Fernandez a IV class chir tree of the lowest dimensions takes 32 years to enter the III class From the percentages given above we have therefore for every 1 000 IV class trees —

	For compartment 9		For compartment 7 10			Naini Tal	Ranikhet.
Class IV	1 000 or	38	1 000 or	38	As compared with the present stock in the forests		-
„ III 44 % of class IV	320	12	440 „	16		11	8
„ II 38 , III	115 ,	4	167 „	6		4	4
„ I 23 5 „ II	27 ,	1	27 ,	1		1	1

Thus the Naini Tal chir forests approach nearer the normal than the Ranikhet ones, where we find that whilst there are very large village requirements for poles, the demand for large timber is below the possibility For every mature tree of the I class we therefore require at least 54 trees of the II, III and IV classes which together correspond closely to Gurnand's II and III classes; but instead of 54 to 1, Gurnand would have only 2 8 to 1—a totally inadequate ratio Doubtless under intense management it would be possible to reduce the present preponderating proportion of the lower classes in the Naini Tal forests, but never to the extent advocated by Gurnand either in these or any other forests. To make a complete enumeration of the whole growing stock over 8 inches in diameter every 6-10 years as prescribed by Gurnand would also be out of the question in the great majority of our Indian forests.

To encourage "young individuals to grow up straight by means of judicious pruning of side branches, correcting of forked growth, pinching off of superfluous buds, snapping off a too luxuriant branch and so on" (*vide* page 16) could not be undertaken in our vast forests of a comparatively low value per acre. Such gardening operations would be quite out of place except in a few special plantations.

Let me try and make my argument still plainer by giving roughly the different number of stems in Mr. Fernandez' table at page 12 in our familiar Indian classes, *viz* :—

I Class over 2′ diameter.
II „ 1½′—2′ „
III „ 1′ —1½′ „
IV „ 6″ —1′ „

Suppose that it is desired to treat the 100 hectares by jardinage on a rotation of 10 years As the rotation is for 10 years it will be practically necessary to have 10 times as many I class trees as in the regular method For purposes therefore of comparison to the number of trees in the I class under the latter method we should add 9/10 deducting a similar number from the II class. We then have —

Class.	Regular Method.		Gurnand's Method	
	No. of stems	Proportion	No of stems	Proportion
I	5,930	1	38,556	1
II	42,585	7	26,068	0·7
III	59,088	10	38,802	1

From what has gone before it will be seen how much nearer the proportion of 1 : 7 : 10 is to the normal than 1 : 0 7 : 1.

Mr. Fernandez states at page 17 that in spite of scientific forestry having been introduced by Sir Dietrich Brandis nearly 40 years ago, no other system of high forest than that of jardinage has yet been adopted in India. It has fallen to my lot as a divisional officer to attempt to carry out three of Mr. Fernandes' most important working plans, one for the Debra Dun Forests with improvement fellings as its main feature, the second for the

Naini Tal forests under jardinage, and the third for Ranikhet prescribed by Mr. Fernandez to be treated on the regular system which he now despises

Of these three plans, the Dehra Dun one cannot be styled a Working Plan at all, but a mere plan of operations for 15 years. No possibility is fixed, only a few sylvicultural rules being laid down which can and sometimes have been interpreted with great laxity. There is practically no check to overfelling and a dangerous amount of power is left in the hands of the divisional officer and his rangers

The Naini Tal plan was not a success not because the jardinage system was a wrong one, but on account of the prescriptions of the plan being too vague The framer, however labored under peculiar disadvantages only one-third of the forests being under the Forest Act when he had to prepare his plan, so that he had to meet a large demand from an inadequate area and did not know either the extent of additional areas which could be reserved, or their resources

The plan which every officer pronounces to be a success who has held charge of the Naini Tal Division (including the present Assistant Inspector General of Forests) is the Ranikhet one with the regular system for its key-note Mr Fernendez in 1896 says :—" The artificial and unpractical character of the old system was apparent to me even during my student days at Nancy (1872-73) and the special experience gained during ten years service as Working Plans Officer and as Professor of Forestry at Dehra Dun only stengthened into firm conviction my early doubts" Mr. Fernandez in 1886, *re* the Ranikhet working plan, writes "The natural reproduction of chir in the Ranikhet forests can be effected with such ease and certainty within a space of 20 years, that there can be no question regarding the expediency of establishing a regular gradation of age classes in every one of these forests " Your readers are left to draw their own conclusions.

Mr. Fernendez knows that for very many years the main work of the Indian Forest Department consisted in forming reserves out of the original chaotic mass of waste lands, and that it was only in comparatively recent years under Dr Schlich's guidance that a beginning was made to bring the forests so reserved under systematic management The present fetish being 'Improvement Fellings,' a plan which does not contain these words is liable to b looked upon with ill favor.

It is by no means however, contended that jardinage is a system to be disregarded, but on the contrary it should be considered as the one which can be more extensively used in India, than any other. The human mind is so constituted that it is constantly making comparisons where none are needed. There is no reason why such methods of treatment as jardinage, the regular method, and the group method, should not *all* be sound

I maintain that they are and that it only remains to discover which is the most applicable to each individual forest. To praise jardinage is not necessarily to condemn the regular system or *vice versa*.

II WORKING PLANS IN FRANCE.

A not very careful reader of this article would come to the conclusion that the regular system (shelter-wood compartment system of Schlich) had been entirely abandoned by the French or was to be given up at the earliest convenient moment It would also lead one to suppose that there was an inherent antagonism between the two systems, of which I for one, as stated above, fail to see the necessity

Mr Fernandez in this article refers to the Dehra Dun working plan stating that an article had recently appeared condemning it as primitive This article was by myself and the reasons for my condemnation are given above Not to fix any possibility in the care of a forest where the demand equals or exceeds the supply, is enough in itself to condemn the plan The interests which tend to fell the finest trees and to fell more than the annual yield are very great The divisional officer is perhaps keen on finance and wishes to show a large surplus irrespective of what may happen in the future The rangers, too wish to make their ranges pay well ; and the contractors by every wile try to get good trees instead of bad ones The Conservator perhaps is not ill-pleased to find a good surplus when writing his Annual Report.

Mr. Fernandez' note on page 27 is instructive He says "It is important to note the word "seems" (parait) For those who can read between the lines there can be no doubt that it has not answered expectations" this does not "seem" fair reasoning No one is justified in stating that a man really means something different from what he says I happened to make a tour through France only a year previous to Mr. Fernandez and my impression was that the regular system was very much alive In fact we were shown two of the finest forests in Europe Lyons-la-Forêts and Bellême treated under this system, under which also most of the high forests in the plains of France are managed It seems in favor with the Germans as well in suitable localities , for the shelter-wood group system of Schlich is really identical, with a practical modification to suit greater difficulties of reproduction, in Germany It is, therefore, no more moribund than the British Empire

That in some instances, however it has been misapplied cannot be denied, but similar errors have been made in the case of all other methods, though this is no proof that they are all bad. French officers have doubtless, in their love for precision, often gone too far in rigorously prescribing that each Periodic Block should be in one compact area, as in the plan instanced by Mr Fernandez Such mistakes are simply errors of judgment by individual officers and in no way affect the value of the method There can be no reason why the periodic block should not be formed of two or more separate areas if demanded by the condition of the forest, and this I stated might be done if necessary in the case of the Thano forest (Dehra Dun) *vide* page 24 of the article entitled 'Tour in France' (Indian Forester July 1895 Then too, there is not the slightest necessity for forming all the periodic blocks at the beginning of a plan, they need only be formed when their turn for regeneration arrives and this is what the note of the Council d'Administration prescribes in its paras 18, 19, and 20 In the very plan which Mr Fernandez cites as proving that the French have abandoned the system under discussion, it turns out that even in this very instance it has not been abandoned at all, but only corrections made in the details of a faulty plan It is even expressly stated in para 9 of the note that the method of treatment hitherto applied is to be maintained

For the great majority of our Indian forests which have to be treated as high forest a properly regulated Jardinage would seem to be the best method of treatment, but I am strongly of opinion that cases exist where it more advantageous to adopt the Shelter-wood compartment method modified, when necessary, by some of the special provisions of the shelter-wood group system I would thus manage some of the almost pure forests of light demanding species where there is no difficulty about reproduction and where timber of all dimensions and fuel is readily saleable Such I consider to be the Ranikhet Chir forests and the greater portion of the Dehra Dun Sal forests It seems difficult to ignore the great advantages which would eventually ensue as regards fire protection and closure to grazing We could afford to take more effective and expensive measures for the protection from fire of the portion under regeneration, and it might often be possible to close this portion to grazing whereas in a forest under jardinage which is heavily grazed as reproduction is going on everywhere, closure to be most effective, should embrace the whole area—which would be impossible We must face the fact that heavy grazing will continue to be one of the normal conditions of many of our Indian forests Mr Fernandez has himself adopted the system of closing the portions under regeneration to grazing at Ranikhet with marked success and for some of these same areas extra precautionary measures against fire have been successfully adopted For purposes of control, it is also highly advantageous to have our big timber concentrated in certain compartments It may be true that trees in a forest of mixed ages grow as tall as in a regular forest, but (other things being equal) the boles are decidedly longer and less knotty in the latter than in the former, points of capital importance in calculating the yield of timber per acre No one who has seen chir of about the same age growing together as closely as their nature permits and chir of all sizes growing mixed together in an open forest would be inclined to deny this

In conclusion my friend Mr Fernandez will, I feel confident, understand that these remarks are not made in a spirit of captious criticism but represent my real opinion on the subject discussed I would ask him, if he wishes to convert his brother officers to Gurnand's method, to write another paper for the "Forester" giving a more complete description of the system

NAINI TAL.
27th September, 1897. N HEARLE.

When an Appendix to the 'Indian Forester" appears under his name of a Conservator of Forests one is rather apt to fight shy of making remarks thereon At the same time I think that articles in the 'Indian Forester" *should* be commented on I have myself sent a few jottings and regret that they have not been *more* commented on, because I wish to get to the bottom of the idea suggestions and notes I do not even mind abuse provided that a reasonable refutation of the suggestions are deduced Now, what I write about now are the lengthy appendices that are coming out with every "Forester" A good deal of the last appendix (III) appeared in German Not all of us are German scholars I believe the Forester is intended for the natives as well as Europeans and what interest could most natives take in German forms which they (and a good many Europeans) could not possibly understand ?

Moreover the forms and tables appear to me far too long, as if so to speak, the author were paid by the page. Please see pages 2, 4, 5, 6, 7, 16, 17, 18, 19 28, 29, 30, 55, to 89, 93, to 108, 126 and 127. Could not these 66 pages be vastly abbreviated ? Some are blank ; some are almost blank ; and it adds unneccessarily to the volume of the "Indian Forester" which one wishes to bind ; not to speak of the waste of paper in all the copies produced Doubtless we shall see the whole later in book form and surely then it will be time enough to have the contents of pages 57 and 58 for instance, printed on separate pages.

"KRITIK"

The Formation of Chlorophyll.

In his letter on the colouring matter of leaves Mr. Lushington states that when trying to extract chlorophyll by pressing leaves, he has only been able to get a muddy brown extract—I quote from memory. Perhaps the following method, recommended for procuring a solution of chlorophyll for orthochromatic photography may be of use to him. The fresh leaves should be cut up small and rubbed in a mortar, and should then be macerated for 24 hours or more in strong alcohol. The solution does not keep well, but it will be less liable to decomposition if pieces of zinc are kept in the bottle.

J. L. MACCARTHY O'LEARY.

Camp Tarsingi,
Ganjam Dt.

I have been attacked from many quarters on what most of my attackers call my "iron colour theory" of leaves. I have not yet, however, heard from those who have attacked me that they have by practical chemistry disproved the theory, but two or three have misunderstood what I meant, considering that I asserted that all coloring matter in leaves was due to the hydrate of iron. That was not what I intended; but that the colouring in leaves was inorganic colouring matter as distinct from organic colouring matter found in other parts of the plant after the evaporation of the sap. I forward herewith some correspondence on the subject.

A. W. LUSHINGTON.

Kistna Division,
4th September, 1897.

Query.

"By the way how do you account for the brilliant *red* colouring of the *young* leaves in Pterocarpus marsupium, Bassia latifolia, Schleichera trijuga? These trees vary from deep scarlet to bright crimson, and *afterwards* turn to *green*. Also the young *pink* leaves on the Ficus religiosa, and the *great range* of colouring in *young* mango leaves? I ask these questions with reference to your letter to the "Indian Forester," where you said (I quote from memory) that the *light* colours of leaves (apart from green) were due to the decomposition of iron salts during the leaf's latter stages and death."

Answer.

"You seem to have come to the conclusion that I inferred that all colouring matter in leaves was due to iron. Not so. I *suggested* (not asserted) that they might be due to *inorganic* colouring matter in contradistinction to *organic* colouring matter; and quoted iron as possibly the cause of the colour where leaves go through (as is *ordinarily* the case) transitions of white, light green, bright green, yellow and brown I think that you will agree with me that chromium and manganese also form constituent parts of leaves. Now chromate of potash is a very brilliant yellow, the permanganate of potash varies from purple to majenta Chromium and manganese vary in proportions in different species, and could not these enter into the composition of the colours? And is it not more likely that these inorganic matters should be more prominent before the elaboration of the sap in the *leaves* than after that elaboration in the flowers juices gums etc? Nor are perhaps these three—iron, chromium manganese—the only inorganic constituents that may affect the colours there may be others Of course I allowed in the first instance that the theory is not one that I have attempted by practical chemistry to prove

W A LUSHINGTON

4th September, 1897.

III. OFFICIAL PAPERS & INTELLIGENCE

The Forest Policy of the Madras Government.

(*Madras G O No* 569, *Revenue*, 13*th July*, 1897.)

In several of the addresses presented during the recent tours of His Excellency the Governor complaints against the administration of the Forest Department have been made in language which indicates a grave misconception of the policy which has been adopted by the Government The main object of forest administration being the protection of future generations from the improvidence of their predecessors, it is impossible for the Government to confine itself to measures which would be altogether in consonance with the wishes of those who desire to retain every privilege which was enjoyed by the people before the gradual disappearance of forest growth rendered some action on the part of the Government an imperative necessity, but it does not seem to be understood that it is the earnest desire of the Government to restrict interference with old and cherished customs, so far as is possible compatibly with the reasonably efficient protection and improvement of the forests and grazing grounds, on which the continued agricultural prosperity of the country so much depends With a view, therefore, to remove misconception on the part of the people and, at the same time, to set forth, in a consolidated form for the guidance of all officers concerned, the policy which has been gradually elaborated as experience has been gained His Excellency the Govenor in Council resolves to issue a statement which will amount to a recapitulation of the salient points of the more important orders, now in force, in connection with forest administration, beginning with that of the 20th October, 1890, since which time there has been no change in the views of Government as regards the general principles to be followed in dealing with the various questions which, from time to time, come up for settlement

2 It will be convenient to deal with the subject under the following heads —

I —Selection of forests for reservation
II —Management of reserved forests
III —Unreserved land
IV —Timber and fuel
V —Fodder
VI —Grazing
VII —Minor produce
VIII —Forest offences

3 *Selection of forests for reservation* —In 1890 after prolonged consideration and discussion it was decided that it was necessary to have under Government control not only timber forests and forests conserved from climatic considerations but also all sources of fuel and fodder supply with regard to which permanency was desired experience having shown that land left for common use was rapidly denuded as population advanced It was also decided that all land so brought under control should be formally settled and reserved the advantages attending a definite determination of rights far outweighing the cost of reservation In the same order it was stated that the reserves should be in fairly large blocks, but a further direction that sufficient land should be taken up to meet all estimated requirements in firewood, leaves and small timber, as well as for grazing, led to a misunderstanding in some quarters, and, in dealing with individual proposals, the Board and the Government had frequently to draw attention to the necessity of leaving to the villagers an ample margin for the extension of cultivation and for free grazing In 1892, it was laid down that as an ordinary rule no area of less than 300 acres should be selected for reservation In 1895, after some correspondence with the Government of India, this limit was raised to one square mile, the object being to avoid interference with village waste scattered throughout cultivated areas. The exclusion of a sufficient margin around village sites has also been habitually insisted on of late years, and in cases in which this was

overlooked in the early days of reservation and inconvenience has been shown to result therefrom, district officers can arrange for the demarcation, and, if necessary, the clearance of a reasonable margin, giving the villagers a written order under section 21 proviso (*a*), of the Forest Act, permitting the exercise of the ordinary village privileges within the area thus demarcated out. Similarly when it is found that crops are suffering from the depredations of pig and other wild animals which find shelter in areas which villagers formerly kept free from forest growth, but which have become reclothed under protection, Forest officers can arrange for the extermination of the animals by organizing periodical beats, which all villagers holding gun licenses should be invited to attend.

4. *Management of Reserved Forests*.—In the same order of 1890 the Government declared in connection with the management of reserved forests that it was most necessary to correct the idea which prevailed somewhat widely *viz*., that as soon as a forest was reserved, cattle and men were to be excluded and the forest worked for profit rather than for the benefit of the people. It cannot be too strongly affirmed that the chief object of reserved forests, throughout the greater part of the country is the provision of pasture, small timber fuel and leaves for manure or litter. In all but special cases they are to be worked in order to meet the wants to the villagers in these respects and are not to be converted into close preserves for the growth of large timber. As control and improvement involve expenditure the levy of fees for forest produce from areas under control is indispensable but, as will be noted in detail hereafter, every effort is made to keep them as low as possible in respect of all articles of forest produce required for agricultural and domestic use.

5. *Unreserved land*. Under the rules issued under section 26 of the Forest Act all land at the disposal of Government, which is not set apart as reserved land or otherwise specially assigned by Government, is held to be ‘unreserved land.” It varies from fairly well-clothed forest land in hill tracts to the barren waste which alone can usually be found in thickly populated agricultural centres, and includes with rare exceptions, every block of unoccupied land which is less than one square mile in extent. Under Rule 7 of the rules all but the most valuable articles of the forest produce of unreserved land are left for the free and unrestricted enjoyment of the inhabitants of villages, so far as is necessary to meet local requirements for agricultural and domestic purposes. These unreserved lands form true village forests, the interference of the district or taluk authorities, except for the preservation of the more valuable trees, being contemplated under the rule only when heads of villages are unable to prevent manifest abuses or when disputes arise as to the villages whose inhabitants are entitled to the use of the produce of any particular

area. Even with regard to the more valuable trees which would soon become extinct if they were not kept under control and charged for, it is intended, as pointed out by the Board of Revenue in submitting the draft rules, that the forest growth on unreserved lands is to be left for the use of the local agricultural community and is not to be cut for sale to outsiders. This rule should only be deviated from in localities in which the supply is obviously far in excess of local requirements. Even when surplus produce exists and is given on contract, it has been directed that village sites and all other areas which are distinctly communal land belonging to villages are to be exempt from the operations of forest leases and contracts.

6. *Timber and Fuel*—Only a very small number of the forests of the Presidency are capable of producing large timber under conditions which permit of its being profitably brought to market. These are almost invariably hill forests or are situated in tracts inhabited only by forest tribes and a few scattered cultivators. Such forests will naturally be worked on strictly commercial principles as regards larger timber, but as small timber, bamboos and fuel will have no local value, concessions may be freely made with regard to these articles when requirements of the kind for local use cannot be supplied from unreserved lands. In the case of reserved forests nearer to well-cultivated tracts where all forest resources must be carefully husbanded, free supplies cannot ordinarily be permitted, but it is a recognised rule that local demands, even from reserved forests, are to be supplied at low and not at competition rates and in the preparation of working plans and schemes, the effect of the scheme upon the neighbouring villagers in the matters of wood supply has always to be taken into consideration. The seigniorage fees prescribed for trees on unreserved lands are by no means high, and, while Collectors are not authorized to raise them, they are empowered to reduce them whenever they see reason to do so. This discretion should be exercised in a generous and liberal spirit when classified trees required for agricultural implements are so abundant that there is no danger of the supply running short. No seigniorage rates have been fixed for supplies from reserved forests, but when these forests are drawn on to meet local requirements, or when they are worked for small timber and fuel to supply large towns and to meet commercial and industrial demands, such as for railways and factories, it is usual to meet local requirements at rates equivalent to the seigniorage rates for unreserved lands *plus* a small charge for felling and conversion, conditions to that effect being inserted in the agreements when the work is entrusted to contractors. Instructions have also been issued for the permission of free gleaning of wood below 2 or 2½ inches in girth from areas recently felled over, in places where there are people to take advantage of it and the gleaners are not likely to dispose of the produce

removed by them to others, than adjacent cultivators for whose benefit the concession is intended Section 104 of the Forest Code also provides for free grants to village communities, or to private individuals in cases of necessity

7 *Grazing*—In the early days of forest conservancy, the operations of the department were mainly restricted to the felling of timber and fuel for commercial purposes, and the rigid protection of the areas brought under control for these purposes seems to have given rise to the mistaken idea referred to in paragraph 4 *supra*, that as soon as a forest was reserved cattle and men were to be excluded Since reservation has been adopted on a large scale, it has always been recognised that grazing must be provided for in any scheme for the management of reserved forests, and, in the papers recorded with G O No 285, dated 23rd June, 1896, it will be seen that the Conservator, Central Circle, has recorded his opinion that the successful management of grazing areas will be the most important feature in forest administration for many years to come The same papers show that the other Conservators are no less alive to the importance of the question and anxious to dispose of it in the manner most acceptable to the people, so far as is compatible with such protection as in absolutely necessary to prevent the gradual deterioration of forests and grazing areas When fellings have taken place or when areas have deteriorated owing to over-grazing a period of rigid protection is absolutely necessary but it has been impressed upon Forest officers that it is a point of the first importance that matters shall be so arranged that the areas closed at one time shall not be so large as to cause undue inconvenience to the people The improvement in grazing capabilities resulting from a period of closure will soon make itself apparent to the people and in the case of lands which have been formerly grazed over free of charge it is especially desirable that District Forest officers should direct their attention to the adoption of carefully thought-out plans for the closure of moderate areas in rotation and for such other measures as may be feasible to secure for the the people who pay fees something more than they formerly got for nothing The deterioration of lands still left open to grazing can also be retarded by putting a stop as far as possible to the removal of cattle droppings In deference to established custom, Government has ruled that, for the present, permit holders are not to be prohibited from removing the droppings of their own cattle, but this permission should not be extended to persons who are not permit-holders

8 The regulation of grazing in reserved forests and the extent to which free grazing should be allowed have been frequently under the consideration of Government and it has been finally decided, in accordance with the principle laid down in paragraph 4 *supra*, that free grazing, save in very exceptional cases, shall be restricted to unreserved lands, and that in lieu of

differential rates on the various classes of cattle, a low uniform rate shall ordinarily be charged for all,—the scale adopted for the present being the very modorate one shown in the margin. These rates cannot be enhanced without the sanction of Government, such enhancement having as yet been sanctioned only in respect of a few districts in which a higher fee had previously been charged and collected without difficulty, and even in one of these districts the higher fee formerly collected has recently been reduced to the standard scale.

	Per annum Rs	A	P
Buffaloes	0	6	0
Bulls, cows, bullocks, calves, horses, asses and foals	0	3	0
Sheep and goats .	1	6	0

9 Owing to the serious damage which goats cause to forest growth, it is impossible to admit them into reserved forests as freely as cattle and sheep, and owing to the manner in which they are able to pick up a sustenance from lands on which cattle could find nothing the necessity for admitting them is not so great, but in localities where goats are numerous and the extent of unreserved land is small Government is desirous that some provision should be made and the Board of Revenue has therefore instructed district officials to make such arrangements for goat-browsing as may be found practicable

10 In the regulation of grazing in reserved forests, the division of the grazing areas into blocks of manageable size and the restriction of the number of cattle to be grazed in each are undoubtedly a goal to be aimed at but before this can be satisfactorily done the capabilities of the various classes of forests must be accurately gauged and, as the enforcement of an arbitrary limit which had the effect of giving some owners of village cattle an advantage over others who considered they had an equal claim is reported to have in several instances given rise to much dissatisfaction, Government has ruled that for the present the number of cattle to be grazed in a reserve should not be restricted This decision having been based on reports that restriction has caused dissatisfaction among local cattle-owners, it will, of course, be understood that the prohibition of restriction is not intended as an instruction to District Forest officers to indiscriminately throw open to outsiders forests which have hitherto been reserved for the supply of local demands

11. In the rules for the issue of permits for grazing, provision is made in rule (i) for the division of the reserved forests of a district into grazing blocks, but, for the reasons given in the paragraph last preceding, the size of the blocks is left entirely to the discretion of the local authorities, and the prescription in rule (iii) of a scale of fees for each block is not intended to preclude forest officers from sanctioning the exchange of a permit for one block for a permit for another in tracts in which nomadic grazing is customary and regarded as unobjectionable.

12 *Fodder* —In the order of 1890, which has already been frequently referred to, stress was laid on the desirability of cutting and storing grass for sale when such arrangements could be shown to be practicable and conducive to the convenience and interests of the people Unfortunately, it is only in a very few localities that the people are in the habit of using dried grass as fodder, and the valuable resources of the forests in this respect are generally wasted This is the more to be regretted as the removal of the annual grass crop would benefit areas temporarily closed to grazing for the generation of growth or for improvement as grazing grounds It is the duty of District Forest officers to do everything in their power to encourage the use of cut fodder, and the practice of inviting ryots to enter reserves and cut grass free in localities in which there is no demand for it on payment, should not be abandoned merely because it meets with no ready response

13 *Minor Produce* —Under Rules 7 and 13 of the rules for unreserved lands, the free use of minor produce on such lands is generally left to the people, and it was recently pointed out by Government that complaints that villagers had been deprived of the free use of fuller's earth lime and stones, were the result of a mistake which was rectified by the Collector of the district as soon as the matter was brought to his notice It is the duty of district officers to use special care to guard against any recurrence of mistakes of this kind in entering into agreements with contractors, and in this connection it is noted that the Board of Revenue has recently called on all Collectors to report whether any modification of the working of minor produce in their district is called for in the direction of withdrawing from any operations which may be found to unnecessarily harass the general population.

14 *Forest Offences* —In connection with prosecutions for forest offences the Government has repeatedly deprecated any tendency to harass the people of the country by an indiscriminate application of the penal clauses of the Forest Act It has laid down as a general principle that simple trespass should not be treated as an offence at all, unless there is reason to suspect that it is likely to lead to more serious offences and, with regard to the power of compounding offences vested in District Forest officers, the policy which the Government has prescribed is clearly set out in the reviews of the Forest Administration Reports for 1893-94 In the first of these papers when dealing with the increase in the number of prosecutions and the percentage of acquittals in certain districts of the presidency, the Government wrote 'His Excellency the Governor in Council cannot too strongly condemn any tendency to unnecessarily harass the people of the country by the application of the penal clauses of the forest law, and desires the Board will issue strict orders to the Collectors of the districts above mentioned with a view to remedying the unsatisfactory state

which appears to exist." In the latter review the following remarks were made regarding the same subject, but with special reference to the compounding of offences against the forest laws:—

"It is clear, however from the steady and rapid rise that has taken place during recent years, not only in the number of cases reported but also in the amount of compensation realized from fees levied in compounded cases, that Forest Officers are year by year making more extensive use of the powers given to them by the Forest law; and to a certain degree this may reasonably be expected since the longer the law is in operation and the better the people are acquainted with its provisions, the more strictly it may be enforced. The total amount of compensation money realized during 1893-94 was, however, more than double the amount levied four years previously and was considerably larger than the corresponding sum recorded for the preceding season of 15 months. As the Board points out, the Collector and District Magistrate of each district is responsible for seeing that the law is worked with due consideration for the interests of the people. The large increase in the percentage of cases compounded and in the amount of compensation levied is, nevertheless, a matter of serious import. The dangers attaching to the system of compounding offences were indicated by the Government of India in reviewing the report for 1892-93. His Excellency the Governor in Council now resolves to reiterate the principles which should govern the exercise of that power. Cases in which the evidence does not appear to be strong enough to ensure conviction should be withdrawn altogether, and the power of compounding should be utilized only when the offence has clearly been committed by the individual in question, but prosecution is deemed inadvisable owing to the existence of special circumstances, such as the petty nature of the offence itself, ignorance of the law on the part of the offender or distance of the scene of the offence from a Magistrate's court . . . It must further be borne in mind that delay in disposal is in itself very harassing to the parties concerned and petty cases in which there has been long delay either in the institution of prosecutions or in the bringing of offenders to trial, should be withdrawn."

15. His Excellency the Governor in Council believes that the principles laid down in this order are as liberal as is possible without disregarding the true interests of the country and he relies on local officers to see that they are given full effect to in arranging the details of district administration, and that every effort is also made to protect the ryots against oppression and rapacity on the part of low-paid subordinates or departmental contractors.

IV-REVIEWS

Forestry in Jeypore State

In the Jeypore State in 1896 there were 282 square miles of forest under the management of one Superintendent, six foresters and fifty guards The former occupies a position between an Extra-Assistant Conservator and a Ranger on the India List; he draws Rs 175 per mensem Of the Foresters only one is trained, and he is blind, the average pay of this staff is Rs 7-8 p m The Revenue collections of the year amounted to Rs 29 568 and the Expenditure to Rs 12,523 leaving a surplus of Rs 17,044 or about Rs 60 per square mile The sources of receipts may be roughly classified as follows

Fuel Rs 4,000, grazing Rs 10,000, Minor Forest produce Rs 8,000, Miscellaneous Rs 2 500 There is apparently no timber in the State Forests, but fines and forfeitures constitute some 7 per cent of the gross receipts

The Local Forest Department evidently labours under considerable difficulties for we are told that public officers do not regard Forest Administration as an integral part of the Civil Administration of the State, and the local Tahsildars not unnaturally vehemently oppose the extension of Forest areas in consequence The Prime Minister of whom the Divisional officer expresses the highest opinion is however well disposed to Forestry and takes a personal interest in the cases which come before him As regards Protection 30 cases were disposed of in Court and 425 were compounded during the year, but some delay appears to occur in magisterial work for 59 cases were pending at the commencement and 42 at the close of the year, so that at least 29 were pending for over 12 months Unauthorized felling or appropriation of produce was the most common offence, not a single case involving damage by fire occurred although 174 square miles of forest were protected without the loss of an acre or the expenditure of a pie It would be extremely interesting if Mr Shiva Buksh would tell us how this is done

Of the total area of State Forests only 13 000 acres are closed to grazing for the whole year, of the remainder 79,000 acres are open for 12 months and 30,000 acres for part of the year, whilst the remaining 59,000 acres though closed to browsing are open to grazing, yet in spite of this liberal policy it was found necessary to impound 3 732 head of cattle This fact however will not surprise us when we discover that 3 54 089 animals are permitted to graze in the available 1,68 000 acres of forest land, for encroachment on the protected 13 000 acres must evidently frequently occur accidentally in the struggle for standing room Trespass in such circumstances may well be leniently dealt with. At the same time it will strike the reader with a feeling akin to awe, when we note that the lac industry was prohibited because it was held to result in depriving the game of shelter ; for with 2½ cows, goats and camels standing in each acre of open forest land, one would hardly think it possible for any wild animal to find time or feel an inclination to dally in the shade. The method of fellings adopted in the State Forest appears to be chiefly coppice from which the outturn is sold or given to State Departments or individuals. The areas operated on are not mentioned so that no idea can be formed of the yield. The Superintendent was occupied with experiments in poppy growing, arboriculture and the tending of exotics besides his legitimate forest work. He writes in a somewhat depressed way of the liberties taken by porcupines, goats and venomous animals ; such a feeling must be accentuated by the extraordinary predilection of his Range officers to spend their nights in the jungle. These subordinates on an average passed 158 nights to 111 days in camp, whilst the trained forester was only 17 days in camp though he passed 261 nights there. The office establishment is apparently strong enough to permit of long absences and poor individual work There are no signs of progress to be detected in the present or anticipated in the future as regards the improvement or working of the forests, and there is absolutely nothing of interest in the report to warrant its being printed or reviewed. The Resolution of the State Council is a dry repetition of the Divisional Officer's introduction concluding with some words of praise for zeal, honesty and economy ; and if, as we believe, Mr. Shiva Buksh takes an interest in forestry and yearns for the sylvicultural welfare of the area in his charge, we can assure him of full sympathy with the difficulties of his position, and of our earnest hope that the Durbar will some day, and that shortly, decide to create state Forests in reality as well as in theory.

Forest Administration in Bengal during 1895-96

The following shows the alteration in the areas under forest protection.

		At commencement of year		At close of the year.
Reserved	Forests	5,839	square miles.	5,877
Protected	do.	3,091	,,	3,437
Unclassed	do.	4,034	,,	4,034
	Total	12,964		13,348

The marked increase in the protected forest was due to the inclusion for the first time of the forests in the Sonthal Pergannas, Nearly all of the unclassed forests are in the Chittagong Hill Tracts, which besides contain 1,518 square miles of Reserves.

The Protected Forest Rules for Chota Nagpur seem tc require a good deal of alteration as they are continually being modified, however, it is to be hoped that by the time the forests are properly demarcated that workable rules will be in force so as to save these forests from their threatened destruction.

We are glad to seet hat the final settlement of the Reserve Forest (reserved under section 34 of the Act in January, 1879) of the three divisions in the Darjeeling district, ordered in 1890, has been completed. Settlements of the protected forests in Singbhoom and Palamau are progressing favourably, while nothing is being done in the Hazaribagh, Manbhoom, and Sonthal Perganna districts. This is to be regretted as experience shows that nothing in the way of conservancy can be accomplished before lines are fixed showing how far villagers may go and where they must stop When these forests were notified under section 28 very undefined areas were fixed, and as the country teams with a scattered population renowned for tree felling, early demarcation is essential 4 000 miles of boundaries were maintained at a cost of Rs. 10,216, of which 456 were spent on the collection of materials for the construction of concrete pillars in the Senchal Forest of the Darjeeling district. The latter is a new departure in Bengal and when the forests are of sufficient value we trust it will be developed. No surveys of importance were undertaken during the year.

Some progress has been made in the preparation of working plans. Plans have been prepared for 213 square miles in the Tista Division, and for 183 square miles in the Jalpaiguri Division by Messrs. French and Haines respectively. and at the same time it is intended to depute an officer to prepare a plan for the large Singbhoom Forests : both the Local Government and the Government of India trust that efforts will be made to increase the percentage that is under working plans.

Attempts have hitherto been made to get this work done by the officers in charge of the Divisions instead of by the appointment of special officers ; this is all very well when the Divisions are small and the work of the D. F O little, but in Bengal this is not the case and we hope that the Conservator will be able to carry out his intention of appointing special officers to do the work.

The total area for which working plans have been completed is 2,538 square miles out of a total area of 5,877 square miles of Reserved forests.

Considerable progress has been made in buildings and roads, 97 miles of road having been constructed at a cost of 14,183 as compared with 73 miles at a cost of Rs 10,227 in the previous year, the former including 24 miles of paths in the Darjeeling Division.

The record of forest offences shows a considerable increase over that of the previous year, the number of cases taken into court being nearly doubled. The latter increase was due to the inclusion in the returns of the cases prosecuted in the new Sonthal Pergannas Division, and to an increase from 21 to 59 cases in the Singbhoom Division

The total number of cases taken into court was 263: of which 90% were convicted, and 1,163 cases were compounded under section 67 of the Forest Act, the total compensation received being Rs. 6,241 The number of cattle impounded were 1,697 head.

As was to be expected in a dry year like the one under report the fire season was a disastrous one; 1,957 square miles were attempted to be protected of which 584 square miles were burnt or a percentage of 29·84 as against 0·49 of the previous year. 238 fires are recorded against 40 of last year's the Officiating Conservator remarks "The year of report was unusually dry and complaints of the drought were made from all parts of the province Special enquiries in connection with the scarcity of water were made in most of the districts of Bengal under orders from Government, and the question was considered in the Bengal Legislative Council of 4th April 1896 The Report on the Government Cinchona plantations in Sikkim says:—such a severe drought has not been experienced for 32 years. Fires do not often occur in the Hills of the Himalayas, but fires are said by the Deputy Superintendent, to have caused great anxiety In the Darjeeling Division fires in the higher hills burnt over 161 acres of the specially protected forest, and 2,733 acres were burnt in the lower hills of similarly protected forests in the Tista Division, a large area for this Division In the Jalpaiguri and Buxa Divisions 3,615 and 18,199 acres were burnt out of the areas specially protected, the percentage of failures in the latter Division being over 11. The above figures exclude the areas burnt in the non-specially protected forests In Palamau 14,401 acres were burnt out of 120,289 for which special measures were adopted giving 11 per cent of failures; while in Singhboom the fires spread over 301,513 acres (471 square miles) out of 468,842 (733 square miles) for which these measures were taken, or over 64 per cent. In Angul the failures were 24 per cent The measures appear to have been exceptionally successful in the Kurseong Division, and this the Officiating Conservator regrets he is unable to explain. The success in Jalpaiguri is due principally to the Department firing the Savannah. In Singbhoom the villagers are not only careless but wilfully ignore fires in the forests on which they depend for their supplies, and often purposely light and encourage these fires There is little doubt that they also wilfully fire the reserved forests to facilitate locomotion in the interior for shooting and collection of fruit."

Strong steps ought to be be taken to check the incendiarism that goes on in the large forests of Chota Nagpur The Conservator remarks that the villagers in Singbhoom light fires in the jungle for easy locomotion , but we understand that besides incendiarism a number of fires are lighted in that part by the people who enter the forest to collect mohwa flowers To facilitate the collection of these they burn the dead grass and leaves under the trees, so that when the flowers fall down they can easily be seen and collected , we suggest that measures should be taken against this practice. Another point we should like to draw attention to is that of cost Form 50 shows that 1,252 483 acres were attempted to be protected at a cost of Rs 10 077 or 1 50 pies per acre in the whole Circle, the protection in Kurseong costing 4 67 pies per acae and that in Singbhoom 74 pies per acre

The difference here per acre is very great and we cannot help thinking that too great economy is the cause of such a large percentage of the forests in Singbhoom being burnt

Out of a total area of 5 897 square miles of Reserved Forests, 516 square miles were opened to grazing all the year round and 300 square miles for part of the year, as compared with 385 square miles opened in 1894 95 the increase being due to the opening of additional areas in the Palamau and Augul Divisions on account of the drought

The small amount of grazing compared with the total area of reserves is due to there being no pasture in the Sundarbans Division (2 092 square miles and little demand for it in the Chittagong and Singhbhoom Divisions

In the protected forests the whole area was opened to grazing. In the reserved forests 41 267 cattle were allowed to graze as compared with 23,559 in the previous year and in the protected forest 438 302 cattle grazed as compared with 178,736 last year ; the total value in both classes of forests at full rates being Rs. 1,10,040 of which Rs 17,118 were realized.

Operations for the improvement of forest growth were carried out principally in the Darjeeling Division where Rs. 5,286 were spent, advantage being taken of the occurrence of a good seed year to fully restock the nurseries,

The total area operated on was 330 acres, of which 226 acres were in the Darjeeling Division, where also 600 acres of the last 3 years' coupes were cleaned and weeded Early thinnings were carried out in the Bamonpokri and Puri Teak plantations but nothing of the kind was done in the Teak plantation at Kaptai in Chittagong, which would probably derive considerable benefit from similar treatment Climbers were cut over 27,536 acres at a cost of 1 42 annas per acre, as compared with 23,261 acres in the previous year

The major portion of the forest area is worked under the "Selection Fellings" system, and during the year a contract was entered into to supply 2 lakhs of broad-gauge sleepers from the Singhboom Forests; this is described by the officiating Conservator as follows:—

> “In Singhboom, on the recommendation of the Officiating Inspector-General of Forests, the work of supplying two lakhs of broad-gauge sleepers to the Rai Bareilly-Benares State Railway was undertaken in January, and about one-fourth of this number were extracted by the close of the forest year. Pending the preparation of a working plan, it is not possible to fix the capability of these forests, and the Inspector-General was guided by the inspection report of 1885, by Dr. W. Schlich. The Divisional Officer, however, fears, as represented at the time that the forests cannot bear this heavy strain on their resources without suffering for some years to come. This work has necessitated considerable road-making, and the selection and marking of trees for felling fully occupied for a long time the extra temporary staff employed. Excepting a few cases of careless selection of trees, no trees under 6½ feet in girth have been cut to date, but the extended operations have made it impossible to prevent a certain amount of damage to the trees left standing. This sleeper work is a heavy strain on the department as the permanent staff of the Division cannot spare time for this additional work, and the work is done by extra temporary and, therefore, untrained establishment, under the supervision of the gazetted officers. One advantage gained is the opening up of good roads, and the work has brought forcibly to notice the fact that in the northern part of the district—the Porahat forest—the trees do not furnish nearly as good timber as those in the Kolhan.

Mr. Wild the Conservator before going on leave left a note on the minor products of Bengal which is reproduced as an appendix to the report, this is interesting and for the information of those who may not have seen it we give it in extenso:—

NOTES ON MINOR FOREST PRODUCE AND THEIR DEVELOPMENT AND UTILIZATION. BY MR. A. E. WILD, CONSERVATOR OF FORESTS, BENGAL.

There has been a large development in this industry, 44 new mines having been opened out during the year under report, out of a total of 222 now in existence, while applications for 22 more are under consideration. The lease of 27 mines, rented at Rs. 225 only, expired during the year and has not yet been renewed. As hinted at last year, the Department does not appear to obtain its full share of this lucrative trade and it is intended to take the matter up in earnest during the coming cold weather. A sum of Rs. 8,249 has been credited to the Department on this account during the year, against Rs. 7,607 in 1894-95. These figures represent, however, the revenue from the reserved forests only, enquiry showing that, for some reason

Mica.

not yet known, the receipts from the protected forests have been credited by the Deputy Commissioner to "Miscellaneous Land Revenue."

The demand for the current financial year is:—

Reserved forests	...	... 9,025	=Rs. 12,343
Protected do	...	... 3,318	

and will, undoubtedly, be increased.

The area covered by these 222 mines is, 141 acres, while the output is estimated at 5 496 maunds valued at Rs 2,72,545. These figures have been procured by the Deputy Commissioner from the lessees; it is evident they cannot be relied on, both the output and market value must be considerably higher.

Quoting from these figures it is not, however, too much to say that the landlord, Government, is satisfied with a very small percentage on the market value of the mica worked *viz.*, 5 per cent The cost of procurement is exceedingly small, and the profits accruing to the leaseholders must be extremely handsome.

Sabai grass (*Ischæmum angustifolium*)

This commodity is still in great demand for the manufacture of paper. During the year the following quantities were imported into Calcutta, Raniganj, &c :—

	Mds.
From Singhbhum forests ...	55,000
„ Sahibganj „ .	3,03,289
Total	3 58,289

The only other centre of any importance for Calcutta is Nepal, the exports from which country are unfortunately not available. Of the above quantity, the Department was credited merely with royalty on that from Singhbhum. Though the Sahibganj supply is all drawn from plantations made by the Paharias of that part of the Sonthal Parganas district on the protected forest area which they have cleared of wood and planted with sabai, Government has not as yet derived *any income whatever* from this industry, not even land tax, the middlemen, the mahajans, and Biparis reaping all the spoil. The sabai fields are within easy distance of the town, where the grass sells readily unbaled at 12 to 14 annas a maund. At the mills the average rate is Re. 1-4 to Re. 1-7 per maund, railway freight being not over 3 annas 5 pies a maund! Since the Department has taken over the forests of the Sonthal Parganas district, the subject is receiving attention. Were, Government to fix a royalty of even one anna per maund only its revenues would be increased by Rs 18,955.

Large presses with steam power work here night and day in the season, and the gathering and carriage of the grass affords labour to hundreds of the population. As the subject is one of great importance, the following extract is given from the Report of the Director, Botanical Survey of India, for 1894-95 :—"Sabai or babar grass has proved amenable to cultivation so far as to yield a small crop at the rate of two tons dry grass per acre, with slight irrigation and a quantity of seed which is being offered to the public, gratis." Perhaps Mr Duthie was unaware of the large extent of sabai under cultivation at Sahibganj, all raised from transplants some years ago!

Though the demand has not probably shown much fluctuation since 1893-94 the income of the Department has risen in a most satisfactory manner, and will most certainly continue to increase. The figures are—

			Rs
1892-93	...	...	1,750
1893-94	...	...	2,714
1894-95	...	...	4,268
1895-96	...	...	6,336

It is rumoured that another grass has been found equal to sabai but the information is doubtful However, when it is understood that the Calcutta mills turn out 360 tons of paper a week, or an equivalent of say 5 00 000 of maunds a year, there is room for wood pulp as well as another grass It is understood that a consignment of 200 tons left Calcutta for Glasgow during the year at £ 4-2 a ton If the cost can be reduced to £ 3-10 and there seems no real reason why it should not, it will, as mentioned in paragraph 84 of last report, undoubtedly compete with *Esparto*

Kamela dye (*Mallotus philippinensis*)

This product is now for the first time treated of separately from other produce with which it has hitherto been classed. During the year a consignment of 30 seers was sent to Messrs. Gehe and Company of Dresden, through the kind offices of Dr. Watt, the Reporter on Economic Products to the Government of India ; it was most favourably reported on and resulted in an order for 20 cwt The rate charged—Rs 25-5-4 per maund—was fixed by Messrs Gehe and Company themselves, and was lower than the Indian market price (the consignment being merely a trial one). The transaction, therefore, resulted in a slight loss, the account standing thus :—

		Rs	A	P.
30 seers	Price realized	19	0	0
	Cost of collection, carriage, &c	23	1	3

But Lisboa remarks :—'The article Kamela finds a ready market and is now worth one shilling and six pence a lb ;" this is equivalent to Rs 102 a maund, and the rate, therefore was charged much too low This is the first venture of the Department to secure a home, or indeed almost any market, and while no doubt there is a large local demand for really good stuff, shows what can be done when conducted in earnest. Samples were retained in the Indian Museum, Calcutta (4½ seers) as well as forwarded to the Imperial Institute, London (5 seers).

Tannins

An experiment was made in the Sundarbans Division to obtain a solid extract of the bark of the mangroves, and samples were forwarded to the Reporter on Economic Products to the Government of India.

Two analyses for tannins of *Rumex Nepalensis* were carried out by Professor Trimble of Philadelphia and by the Agricultural Chemist to the Government of India. The result gave 5·5 to 6·3 per cent, which are not sufficiently favourable to give the root any practical value as a tanning agent. The reactions indicate the tannin to be identical with that from oak bark. For his interest in the tannins the Conservator was, during the year, elected as a corresponding member of the Philadelphia College of Pharmacy.

Fibres

Enquiries have been made (as a substitute for the true rhea) for ribbons of a nettle common to the forests above 3,000 feet, and a contract entered into at a very low figure, but as the result is still problematical the species is not communicated.

There seems every probability of creating a market, both home, perhaps, as well as local, for a fibre hitherto but little known, which grows in enormous quantities in certain tracts. Reports so far received are very highly favourable and it would indeed seem probable that through the kind instrumentality of Dr George Watt, the Reporter on Economic Products to the Government of India to whom the sincere thanks of the Conservator are due for the very valuable assistance at all times accorded in the development of the minor products of the Bengal Forests, a means of utilizing the immense supplies of this product has at last been found.

Match wood

No less than 23 samples of different kinds of woods have been sent to the Bengal Safety Match Manufacturing Company, Limited, Calcutta, for experiment, and some 11 kinds have been pronounced as suitable for the manufacture of matches, but so far no practical results have ensued."

The following statement gives the details of outturn for the year including estimated removals by privileged villagers —

Class of forest and agency by which produce was removed	Timber	Fuel	Bamboos	Minor produce
Reserved	C ft	C ft	No	Rs
Government	194 585	95 606	14 757	242
Purchasers	4 451 933	12 266 470	7,142 692	1,01 843
Free grants	3 001	21 6 4		569
Right-holders		1 359 185	683 200	8,211
Total	4 649 519	13 772 885	7 840 649	1,10 855
Protected				
Government	10 757	6 436	83 555	4
Purchasers	338 738	4 267 219	359 926	23 036
Free grants	5 083		900	19,361
Right holders	184 030	14 463 312	4 000 000	1,67 259
Total	538 608	18 736 967	4 444 381	2 09 660
Unclassed				
Government	9 483	2 837	6 725	
Purchasers	359 870	172 270	8 408 808	8,349
Free grants		-		
Right holders	-			
Total	369 353	175 107	8 415 533	8,349
GRAND TOTAL IN 1895 96	5 557 480	32 684 939	20 700 563	3 28,864
GRAND TOTAL IN 1894 95	4 493 234	30 195 622	22 049 274	2 72,942
Difference in 1895 96	+1 064 246	+2 489 337	—1,348 711	+55,922

Financially the year was the best on record, as may be seen from the following table

Financial year.	Receipts	Charges	Net Revenue
	Rs	Rs	Rs
1891-92	7 89,553	4 22 930	3,66,623
1892-93	7,44 882	3,81 608	3,66,274
1893-94	8 01 011	4 04 043	3,97,568
1894-95	7,95 673	3 98 601	3,97,072
1895-96	9,18 709	4,66,068	4,52,641

The increase under receipts was notably under timber and fuel in the Sundarbans and Darjeeling divisions The increase under charges was due to the departmental sleeper work in the Singbhoom, Kurseong, and Angul divisions to increased expenditure on roads and buildings, and to there being two supernumerary gazetted officers on the Bengal list Of the divisions Darjeeling, Tista, Kurseong, Jalpaiguri Sundarbans and Chittagong show a surplus, while Buxa, Sonthal Parganas, Palamau, Singbhoom, Angul and Puri show a deficit The total surplus of the Sundarbans Division was Rs 4,63,961 or more than the total of the whole circle.

VI -EXTRACTS NOTES AND QUERIES

The Exudation of Gum from Fruiting Stalks of the Mahua.

An interesting phenomenon with regard to the Mahua tree which hitherto seems to have attracted little attention has recently been noticed in the Hoshangabad Division of the Northern Circle, Central Provinces The Divisional Forest officer records that, after the fall of the mahua flower this year a peculiar substance of the consistency of gum was observed to exude from the fruiting stalks It is described as very sweet and sticky and tasting like toffee In the above division it appears to have occurred in large quantities and was greedily consumed by the poor people On further enquiries being made in other Divisions, little or no information on the subject could be obtained, indicating that the phenomenon is either of periodical occurrence or, if annual, confined to a few localities and certain isolated individuals In the Jubbulpore Division a kind of milk or gum' is said to exude from the stalk after the mahua fruit has fallen but the excretion occurs in small quantities and only on a few trees The phenomenon is described as being of yearly occurrence in the Betul Division and in two Ranges of the Mandla Division but this assertion is based on information obtained from subordinate officers and Gonds From four other Divisions no information at all on the subject could be obtained Hence no details are at present available as to the exact place of origin of the exudation, whether from the scars left by the fallen corolla, from the end of the shoot after the fall of the fruit or from some specially developed secreting tissue, whether the exudation is noticed when the flower has not been fertilized whether it ceases soon after the fall of the flower or continues during the maturing of the fruit, whether the phenomenon is noticed on indiv dual trees or only on certain branches of different trees, and whether it is of yearly occurrence or particularly prevalent in certain years remarkable for drought or otherwise. However, now that attention has been drawn to the subject, it is to be hoped that observations will be made, where possible, for the purpose of supplying reliable information concerning these and other details, as the subject is an interesting one.

R S HOLE,

Asst-Consr of Forests, Jubbulpore.

Chinese Insect White Wax.

In the August number of the United State Consular Reports a very interesting account is given of that curious substance known as Chinese Insect White Wax which until quite recent years was one of the most mysterious of the many mysterious industries of China. Some years ago, Mr Baber of the British Consular, service in China, published an elaborate report on the subject, based on information which he obtained during many years of residence and travel in Western China, but this report, interesting as it was, has by this time shared the fate that speedily attends all official publications, and therefore, we need not apologise for referring to this new report of Mr Smithers, the American Consul at Chungking, the commercial capital of Szechuan

Chinese books nearly four hundred years old mention the wax, but at that time, the notion was that the insects did not excrete the wax, but were themselves, by some strange metamorphosis, converted into a white substance which became wax. Although Szechuan province is the chief breeding ground of the insect, and the centre of the production and manufacture of the white wax of commerce, the wax is found in most of the other provinces of China A little to the west of the 102nd degree of longitude, the Yangtsze is joined by the Yalung river ; the united waters flow south eastwards below the 26th degree of north latitude, and again turn north forming a great loop the outer side of which is turned towards Yunnan Before the Yalung joins the Yangtsze, it is itself joined by a stream called the Anning, which flows down the Ning Yuan valley, Ning-Yuan being the chief town of the Yangtsze loop already mentioned This valley is the great breeding ground of the white wax insect It is about 6,000 feet above the level of the sea, and on the hills bounding the valley is one very prominent tree, called by the Chinese the insect tree. It is an evergreen with leaves springing in pairs from the branches They are thick, dark green, glossy, ovate and pointed. At the end of May or beginning of June, the tree bears clusters of small, white flowers, which are succeeded by fruit of a dark purple colour The authorities at Kew have decided that the tree is the

Ligustrum lucidum, or large-leaved privet In March numerous brown pea shaped excrescences are seen attached to the bark of the boughs and twigs , the larger ones, or scales, are easily detachable and when opened, present either a whitish-brown pulpy mass, or a crowd of minute animals like flour, whose movements are barely perceptible to the naked eye In May and June, the scales when opened are found swarming with brown creatures crawling about each provided with six legs and a pair of antennæ Each of these was a white wax insect Many of the scales also contained either a small white bag or cocoon covering a pupa or a perfect imago in the shape of a small black beetle If left undisturbed in the broken scale, the beetle, which, from its ungainly appearance, is called by the Chinese the buffalo, will, heedless of the wax insects which begin to crawl inside and outside the scale continue to burrow in the inner lining of the scale, which is apparently its food The Chinese declare that the beetle eats the wax insects or at least injures them by the pressure of his heavy body and it is true that scales in which beetles are numerous are cheaper than those in which they are absent The beetle in fact is a parasite on the wax insect and the grub, not the imago is the enemy of the wax insect When a scale is plucked from a tree, an orifice where it was attached to the bark is disclosed By this the insects are enabled to escape from the detached scale

Two hundred miles to the north-east of Ning-Yuan valley, and separated from it by a series of mountain ranges, is the prefecture of Chia-ting within which insect white wax, as an article of commerce in produced At the end of April the scales are gathered in the Ning-Yuan valley, and collected mostly at the town of Te-Chang, on the Anning river already mentioned To this town porters from Chia ting resort annually in great numbers—as many it is said, as ten thousand —to carry the scales across the mountains These are made up into paper packets each weighing about a pound, and sixty of these make the usual load Great care is taken in transit The porters travel at night for the temperature is high enough during the day to cause rapid development of the insects, and lead to their escape from the scales At the resting places, the porters spread out the packets in cool places , but in spite of these precautions each packet is found to have lost an ounce in weight on its arrival at Chia ting In years of plenty the pound of scales laid down at Chia-ting costs about half-a-crown, but in a year of scarcity, like last year when only a thousand loads reached Chia ting the price is doubled In favourable years, a pound of Chia-ting scales is calculated to produce from four to five pounds of wax , in bad years little more than one pound is to be obtained, so that the industry has a considerable element of risk.

West from the right bank of the Min river on which the town of Chia-ting lies stretches a plain to the foot of the sacred Omei-mountains This plain is an immense rice-field, and is well watered with streams from the western mountains. Almost every plot of ground on the plain as well as the bases of the mountains, are thickly edged with stumps varying from three to a dozen feet in height, with numerous sprouts rising from their gnarled heads. These resemble at a distance pollarded willows. The leaves spring in pairs from the branches. The tree is known to the Chinese as the white wax tree, and it is to these trees that the scales are brought from the Ning-Yuan valley. On their arrival about the beginning of May, they are made up into small packets, of twenty or thirty scales which are enclosed in a leaf of the wood-oil tree, the edge of the leaf being tied with rice straw by which the packet is suspended close under the branches of the wax tree. A few rough holes are drilled in the leaf with a blunt needle so that the insects may find their way through them to the branches. They emerge and creep rapidly up the branches to the leaves, where they nestle for thirteen days. They then descend to the branches and twigs, where the females develop fresh scales in which to deposit their eggs and the males to excrete the substance known as white wax. This first appears as a white coating on the lower sides of the boughs and twigs and resembles sulphate of quinine or a covering of snow. It gradually spreads over the whole branch, and after three months attains a thickness of about a quarter of an inch. When the white deposit becomes visible on the branches, the farmer goes round belabouring the stumps with a heavy wooden club during the heat of the day to rid the trees of enemies of the wax insect. After a hundred days from the placing of the insects on the trees the deposit is complete, the branches are lopped off and as much of the wax is possible removed by hand. This is placed in an iron pot of boiling water and the melting wax rises to the surface, is skimmed off and placed in a round mould whence it emerges as the white wax of commerce. The twigs and branches are then thrown into the pot and the wax thus obtained is darker and inferior. Finally, the insects which have sunk to the bottom of the pot are placed in a bag and squeezed until they have given up the last drop of their valuable product, when their short and industrious career is closed by their being thrown to the pigs. As this process destroys all the scales and all chance of a new generation of insects, it is necessary to have recourse yearly to the Ning-Yuan valley for fresh scales with eggs or insects.

Since the use of kerosine oil has become almost universal in China, the demand for white wax has decreased considerably and the supply has naturally declined in the same ratio. The ten thousand porters once necessary to carry the scales over the mountains, are now reduced to a thousand ; and now candles are used only in the lanterns which people carry when going about at night. Twelve years ago, 454 tons, valued at about £200 a ton reached Shanghai from the Yang-tsze ports ; not long before this, the price was double that quoted here. In Western China the sole use of the wax is for coating the exterior of animal and vegetable tallow candles, and for giving greater consistency to these tallows before they are manufactured into candles The insect white wax melts at 160 degrees F, while animal tallow melts at about 95 degrees F Hence vegetable and animal tallow candles are dipped into melted white wax, they thus get a coating which prevents them from guttering when lighted The white wax is used in the other parts of China as a sizing for paper and cotton goods, for imparting a gloss to silk, and as a furniture polish Chemists are also said to use it for coating their pills, and in certain of the coast provinces it is used to impart a polish to steatite, or soapstone, ornaments after the carving is completed. "Such then," concludes Mr Smithers, ' is a brief history of the production, manufacture, and uses of Chinese insect white wax, a substance interesting from a biological, as well as from a commercial, point of view '—*Rangoon Gazette*

The oldest Poplar in France

The citizens of Dijon France recently voted a sum of money for putting a railing round a tree standing within the city limits The tree bears a label which informs the sight-seer that it is the oldest Poplar in France The Town Council has a record tracing the history of the tree since the year 722 A D It is 122ft in height and in circumference —*Scientific American*

The Australian Salt Bush

Professor Hilgard of the California State University says that the Australian Salt Bush can be grown successfully on arid and Jalkali lands, that it removes from the soil large quantities of Sodium carbonate and Sodium chloride, the two most injurious alkaline salts In soils therefore, where the percentage of alkali is near the danger point they may be sensibly relieved by planting salt bush for several seasons The yield is nearly equal to that if Alfalfa.—*Scientific American Supplement.*

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

3rd September, 1897.

EAST INDIA TEAK.—The deliveries for the first eight months of 1897 are 11,868 loads against 13,783 loads for the first eight months of 1896. For August the figures are 1,155 loads as compared with 1,713 loads in August 1896. Prices of wood of reliable quality both here and afloat have been maintained, while the stock in the docks though large still shows no great quantity of prime parcels.

ROSEWOOD.—EAST INDIA.—Is in steady demand at good prices.

SATINWOOD—EAST INDIA—each dull of sale, supplies having been too liberal.

EBONY.—EAST INDIA.—For small parcels, of really good wood, fair prices could be made,

PRICE CURRENT.

Indian teak	per load	£10 10s.	to	£15 10s.
Rosewood	,, ton	£8	to	£10
Satinwood	,, sup. foot.	5d.	to	12d.
Ebony	,, ton	£7	to	£8

Denny, Mott & Dickson's Report.

LONDON, 1st SEPTEMBER, 1897.

TEAK.—The landings officially recorded at the Docks during August, not including a Moulmein cargo of 510 tons arrived on the last of the month, were 1889 loads of logs and 379 loads of planks, whilst the deliveries amounted to .767 loads of logs and 272 loads of planks. The Dock stocks at the end of August consist of :—

	10.260	loads of logs,	as against	8,625	loads at the same date last year.
	2,259	,, planks,	,,	2,480	,, ,, ,,
	24	,, blocks,	,,	109	,, ,, ,,
Total	12.543	loads	,,	11,214	loads ,, ,, ,,

The stock of really good Teak is not at all excessive, a considerable proportion of the above official return actually consisting of timber distinctly below the standard of quality which London buyers require as a rule, and therefore not likely to find a ready sale. It is regrettable that occasional cargo-shippers do not seem aware that London is the best market-depôt" only for high-class timber, inferior Indian or Bazaar quality logs hanging on hand generally for lengthy periods, until either transhipped or forced off at a loss, as being to a great extent outside of the conditions of demand and supply in this principal Market for the article. We notice, at length, evidence of a tardy but distinct revival of demand for Teak on the Continent, which is always an encouraging feature; the foreign markets always following that of London at a marked and usually very respectful interval of time, and an upward movement with greater hesitancy than a downward one, such activity augurs favourably for a firm and full pulse of the general trade both in the United Kingdom and abroad during the Autumn and Winter months. Advices from Burmah and Siam continue to harp on the expected short supplies of round logs fit for conversion into first-class' European squares; the extent of which dificiency, however, we consider to need demonstration by the light of later up-river advices than have yet come to hand. Teak planks are firm and saw millers are indifferent as to booking forward orders, those already on hand being in not a few cases in excess of the normal output of the mills for some time to come: and this applies in still greater measure to the conversion of blocks. We have noticed lately an improvement in the preparation of parcels of both planks and blocks arrived on our market; which merits approval, and was necessary to justify any advance on prices of planks-parcels imported earlier in the year.

MARKET RATES OF PRODUCTS.

Tropical Agriculturist, October, 1897.

Cardamoms		per lb.	3s.	to	3s. 1d.
Croton seeds		per cwt.	50s.	to	60s.
Cutch		,,	9s. 3d.	to	32s. 6d.
Gum Arabic, Madras		per ton.	20s.	to	55s.
Gum Kino	,,	,,	£45	to	£55
Indiarubber,	Assam	per lb.	1s. 9d.	to	2s. 4d.
,,	Burma	,,	1s. 4d.	to	2s. 1d.
Myrabolams,	Bombay	per cwt.	4s. 3d.	to	9s.
,,	Jubbulpore	,,	4s.	to	7s.
,,	Godavari	,,	3s. 9d.	to	5s. 6d.
,,	Calcutta	,,	3s. 6d.	to	5s. 6d.
Nux Vomica, Good		,,	7s.	to	7s. 6d.
Oil, Lemon Grass		per lb.	2$\frac{3}{8}$d.		
Orchella, Ceylon		per cwt.	10s.	to	12s. 6d
Sandalwood, logs		per ton.	£30	to	£50
,,	chips	,,	£4	to	£8.
Sapanwood,		,,	£4.	to	£5.
Seed lac		per cwt.	70s.	to	80s.
Tamarinds (Madras)		,,	4s.	to	6s.

CORRIGENDA.

September, 1897.

Table of Contents 6th line from top, for "K,C.D E" read "K C.I E,"
p. 330 12th line from top, for "Lawrance" read "Lawrence"
" " 24th " " " after words "patient perseverance of" add "Colonel Dickens."
" 332 19th and 22nd line, for "*Mesna*" read "*Mesua*"
" 334 9th line from below, after word "bring" insert "about."
" 336 3rd " " " for "solation" read "rotation."
" 338 in Statement for "follows" read "fallows"
" " " " " "miles" " "mile"
" " " " " "Cawnp" " "Cawnpore."
" " " " " "322,036" " "322,236."
" " 23rd line from below for "*Globulus*" read "*globulus*"
" 343 8th " " " " "*Sempervirus*" " "*sempervirens*."
" " 7th " " " " "*ledrus*" " "*Cedrus*"
" 344 7th " " above " "on" " "of."
" " 9th " " " " "then" " "than"
" 347 9th " " below after "circle" insert full stop and for "the" read "The."
" 359 21st line from below for "monilform" read "moniliform"
" 360 21st " " " for "Kistana also" " "Kistna; also."
" " 19th " " " after land insert full stop and for "the" read "The."
" " 7th " " " for "inflorexence" read "inflorescence."
" 361 11th and 12th line from above for "ivory, white" read "ivory-white"

October, 1897.

p.p **377** to 384 *for* "Gurnand" *read* "Gurnaud" **wherever the name occurs.**

THE

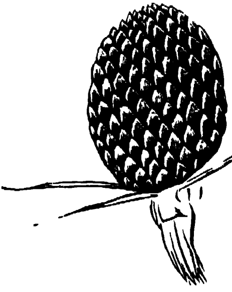
INDIAN FORESTER.

Vol. XXIII.] November, 1897. [No. 11.

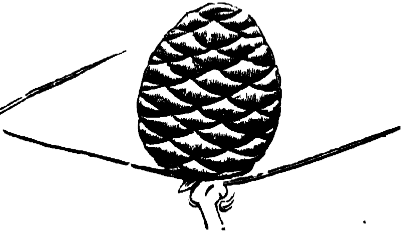
The Fructification of the Deodar.

Our correspondent "S A. C" sends us the following note :—

" I have made during the last 12 months a most careful study of the fructification of Deodar, which may interest you. Both male and female flowers appear first with light brown covering sheaths. The covering sheath opened in 1897 as regards the male flowers from the 25th July, and in a very few days the majority of male flowers appeared. However, there were some late individuals and some only come out in the end of August. The first female flower I observed naked was on the 1st September. There is no difficulty in recognizing the female even in the early stages of growth, and in fact with a magnifying glass its characteristics can be ascertained when still enveloped by its sheaths. In the male flowers the scales are closed up from the very beginning (*Fig I*). In the female flower they are gaping (*Fig II.*) There is very little difference in the general shape at the outset, which can be seen by comparing the female with a late appearing male ; but of course when the female appears, the majority of males have already assumed an elongated shape. When the pollen is shed the females are moist and the pollen sticks to them. They then seem to assume a little rounder appearance for a fortnight or so, and then the growth comes to a stop till the following March, or is at least imperceptible. From March to the end of August they increase in size and then the ripening time begins.



Young male Cone.
Much enlarged.



Young female Cone before fertilisation.
Much enlarged.

'In the majority of cases males and females are on separate 'trees, but they are also found on the same tree, when, as a rule, 'the females occupy the lower and the males the upper branches. 'I have never observed males and females on the same branch As 'regards this, I have been contradicted, but people did so from 'memory only, and as yet I have had no proof that my observation 'is incorrect"

During a recent tour in the Jaunsar Forests, a very large number of Deodar trees were examined and the results fully confirm the observations contained in the last paragraph The number of trees found with only male cones was very largely in excess of those with female cones or with both and from all accounts it appears highly probable that many of the trees never produce anything but male cones If this should prove to be the case, the importance of ascertaining which are the female trees and marking them before any fellings are made, becomes at once apparent, and we hope that other officers will further investigate the matter and inform us of the results

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The After-training of Coopers Hill Men.

In our last issue there appeared a letter from "Scrutator" in which he recommended that every young forest officer should, on joining, undergo a further course of a year's training at Dehra Dun The subject is hardly a suitable one for discussion in these columns, but as we have seen 'Scrutator's' letter quoted as representing the views of the "Indian Forester' we think it desirable to state that in our opinion there are a number of considerations which render "Scrutator's" proposals altogether impracticable.

We quite agree with him that men without sufficient experience should not be pitchforked into the charge of Divisions, and that newly joined forest officers should not be stationed in places where they have no opportunity of learning the ordinary operations of forest work But if such things happen, it is the fault of the Conservators who advise Government in regard to the posting of officers, and the remedy lies in their own hands There are in all provinces some Divisions which are more advanced than others and the newly joined forest officer should invariably be posted to one of these, and kept there until he has gained sufficient practical experience and is able to make himself understood in the language of the country

We would also enter a protest against the sweeping condemnation of the Cooper's Hill trained men implied in the first paragraph of "Scrutator's" letter We have come across a good many of these men and we cannot call to mind a single one who has shown a dislike for his work; in fact our experience has been quite in the opposite direction.

II.—CORRESPONDENCE.

Concentric Rings in the Mangrove.

With reference to your enquiry in the August number p. 324, I venture to suggest that in making the investigations which you very rightly recommend, particular attention may be paid to the species of tree observed. *Avicennia* is not really a true Mangrove in the botanical sense, as it belongs to the natural order 'Verbenaceæ' instead of to the 'Rhizophoreæ' which contains the species most ordinarily known as Mangroves.

In the 'Dictionary of Economic Products,' Dr. Watt gives as species yielding Mangrove bark, the following, in alphabetical order.

Avicennia officinalis	**The White Mangrove.**
Bruguiera gymnorhiza	
" parvifolia	
Ceriops Candolleana	**The Black Mangrove.**
" Roxburghiana	
Kandelia Rheedii	
Rhizophora mucronata	**The true Mangrove.**

all except the first, belonging to the 'Rhizophoreæ.' To this list might be added a few other trees of the tidal forests, such as:—

Combretaceæ	Lumnitzera racemosa.
Lythraceæ	Sonneratia acida.
	" apetala.
Myrsineæ	Ægiceras corniculata.
Euphorbiaceæ	Excæcaria Agallocha.

all of which have, more or less, the curious property of giving out leafless root-suckers in the delta mud. So that it is very necessary, in making observations, to be very sure of the species, especially as, so far as I know, none of them shew clear and definite annual (or periodical ?) rings.

The rings shewn by *Avicennia* are obviously in no way periodical for they are not concentric and run into each other. The question was discussed in the 'Indian Forester' for 1893, Vol. XIX p. 104 and a picture of a section of *Avicennia* wood was then given, a glance at which will shew clearly the character of the curious rings which that wood shews, in common with some other of our woods and notably the *Dalbergia paniculata*.

It will, indeed, be a useful contribution to our knowledge of the nature of wood-rings in general, and of those of *Avicennia* in particular, if those who have it in their power to investigate the subject will work it out thoroughly and explain their formation, and ascertain how far, if at all, the curious structure of the wood of the *Avicennia* is caused by periodical phenomena such as the tides.

The woods of all the species herein mentioned as belonging to the tidal forests and coming, more or less, under the general term 'Mangroves' are well known, but only the *Avicennia* shews the peculiar structure of alternate layers of pore-bearing tissue separated by narrow belts without pores which belts are not concentric but occasionally run into each other.

J. S. GAMBLE.

Calotropis procera and gigantea

In the "Forester" for September it is stated that an expert is coming to experiment with the above-named plants, and G. M. R. asks for information or opinion on certain points He probably knows as much as anybody about C procera. To begin with a trifle, it is a very mild statement that the fibre has been known for 20 years or more. A fibre that is used to the exclusion of all others for every important purpose, except clothing and large ropes, for which it is not common enough. must have been known to the people of Alexander's time, if not of Noah's, and the poor young merchant adventurer who left his bones at Tatta sometime about the middle ages had no doubt as good a practical acquaintance with it as we have.

As to quality, it is stated that the fibres of both species are equally good. That is a statement that I have hitherto taken for truth, and have now to suffer certain qualms of conscience, because I knew the fibre of C. gigantea to be neglected in the Deccan, where it is common, and never suspected the possible reason, *viz*, its uselessness. However that may be, I found the fibre of C. gigantea quite useless in the Saharanpur District in the month of February. We have thus to find out when and where this species is worth gathering. That being the case it is little consolation to be told that this fibre gives a greater proportionate yield.

As to cultivation, I considered the matter some twenty years ago, and came to the conclusion that it could not pay, and think so still, principally on the ground that the plant is of a straggling light-demanding habit and could probably not be grown dense enough to give any considerable yield, but I made no experiments on the point, and that is the only reliable source of information.

F. GLEADOW.

Kaulia Babul.

The two varieties of Babul mentioned by Sir D. Brandis are perfectly well known in the Deccan (Poona, Sholapur, &c, Districts,) where they go by the names of "Vedi Babul" and "Godi Babul," and the two varieties fetch quite different rates in the local markets. In some cases it is easy to distinguish between them, but on the other hand it frequently happens that the native himself cannot say for certain which species a given stem belongs to. For this reason I always regarded the case as one of simple mongrelism, not worth study; possibly, when all the Deccan Reserved Forest "has been taken out of the control of the Forest Department and placed in that of the village officers who are so much more honest and accommodating, it may be interesting to study the question, if there are any forest officers, or any Babul left in Deccan.

F. GLEADOW.

Without presuming in any way to answer all the queries of Sir Dietrich Brandis contained in his letter to the "Indian Forester" of September. 1897. or to point out the differences between the "Kaulia" and "Telia" babuls of the Berars. I trust the following remarks may be of some use to Sir Dietrich Brandis, as I have had opportunities of seeing both these babuls during the last 20 years, from the borders of the Berars on the Purna river, in the north-east of the Khandesh District, right away through the Bombay Deccan as far south as the Satara District on the Krishna river.

In the Northern part on the Purna and other tributaries of the Tapti, you will find that the "Kaulia" predominates over the "Telia," almost to its exclusion in the babul forests, and on the Godavery the former is, as a rule, the most numerous, but as we get further South on to the Bhima and its tributaries the "Telia" increases, whilst in the extreme south on the Krishna, the latter predominates, and the "Kaulia" is only seen in a few places, occupying the same relative position to Telia, that "Telia" does to "Kaulia" on the Purna.

I presume from Sir Dietrich Brandis' letter that "Kaulia" and "Telia" are local names to North and East of Khandesh outside of Bombay, but in Khandesh on the Purna river immediately adjoining the Berars, the local names are "Kowri" and "Teli," terms significant of the value of the trees; whilst in the Deccan proper, the "Kowri" becomes "Vedi" or mad babul, and the Teli the "Godi" or sweet babul, terms again significant either of the respective values or, may be, of the general structures of these two varieties of the Acacia arabica.

There can be no doubt that these two trees should have distinct scientific names, though beyond the very apparent difference in the shape and size of the pods, already noted by Sir Dietrich Brandis, I do not think any really trenchant characteristics will be found between the flowers and fruits of these two trees. The flowers I consider to be identical and the individual seeds can not be distinguished when mixed together.

The leaflets I should say could not be described in words, for one variety, which would not apply to the other. The spines or thorns in the same locality, of the two varieties, it is true, are different; those of the "Kaulia" being longer and stouter than those of the "Telia" and the colours are often white and brown but the variations merge one into another, and it would be difficult to give two descriptions to cover each separately without describing either or both in another locality. I think, myself, that the ramification, the bark and the wood of the two trees are the really divergent characteristics, which no one can mistake. As regards the ramification, "Kaulia" called no doubt "Vedi" or mad on this account, has an interlaced crown with twisted angular branches which keep more or less in one horizontal plane and the general outline of its crown might be likened to a mushroom. The "Telia" has, on the other hand, but a slightly curved twist on its branches and they all incline more or less upwards. In fact the extreme type of this variety is reached in the "Ram Kanti" which excepting its besom-shaped crown is absolutely identical to the Godi babul. I should however add that it is segregarious and comparatively rare.

As to the difference in barks, Sir Dietrich Brandis has already described it, and though on paper it may not sound a very great difference, there can be no doubt about the difference when one sees the trees side by side.

Again, as regards the wood, that of the "Kaulia" is considered absolutely useless for building purposes or for agricultural implements, whilst the "Telia" is used by the Deccani for every conceivable use in which good and strong timber is essential. The price of two large sound logs of equal size in forests of these two varieties, would be as 1 to 5. The "Kaulia" being considered as only fit for firewood. Still it would be hard to describe the two timbers except by words of comparison and say that the heartwood of the "Kaulia" was lighter in colour and more porous in texture than that of the "Telia" grown in the same place.

I notice Sir Dietrich Brandis says, the babul coppices readily. This is true for the Bombay Deccan, with the reservation that the coppice shoots never grow beyond a stunted bush, which in turn dies off at an early age. I noticed this particularly on the embankments of the Dhond and Manmad Railway in the early eighties and again ten years later on the embankments of the S. M. Railway, where the officials had cut back the grown trees leaving the stools in the ground. In our own forest operations the roots are carefully removed as the re-shoots never come to anything, whilst the quantity of material is increased, the cost of grubbing up, especially for large trees, is less than for felling the same quantity with the axe and the ground can be worked up for re-sowing twice as well

I have never heard of the "Kaulia" bark being sought after, but that of the "Telia" is considered valuable for tanning in certain localities, in others its price is not so great. But in departmental felling I always had the living trees barked and the bark sold separately, with generally good financial results, except in Satara, where the uses of this product seemed but little appreciated or known The barking, I also found, was the means of destroying large numbers of the larvæ of longicornes, which commit terrible havoc amongst our babul forests in the Deccan. In the Bombay Deccan the gum is not a source of revenue to the Forest Department from either tree, in fact the quantites that exude do not repay collection

The ' Kaulia" and "Telia" pods are considered of equal value as food for sheep and goats in the Deccan. As regards flowering, both the varieties, as far as my memory serves me at this moment, seldom seem to be devoid of the yellow globose flowers and there are always some pods of various ages to be found adhering to the trees, but the main crop of pods seems to come on about the beginning of March from which time until the beginning of May the shepherds are busy knocking them off with long poles.

I am sending you some specimens of flowers and fruit, collected this month, of both varieties [*] The trees from which they were collected stand on the banks of the "Mutha-Mula" river near Poona.

R. FAGAN.

POONA :
25th October, 1897

The Gurnaud System.

I thoroughly endorse "Kritik" by saying that the necessity of binding a number of French and German forms, contracts, &c., roused feelings in my breast which did not come under precisely Head 1, Pleasure, Sub-head (C) Gratitude.[†]

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[*] These have been received and *forwarded* to Sir Dietrich Brandis.

Hon. Ed

[†] We would remind our correspondents that they should not look a gift-horse in the mouth. The appendix series is printed by the Government of India and presented gratis to the subscribers to the Indian Forester—Hon Ed.

Now to the matter in hand. When those most interesting and valuable papers by Mr Fernandez' appeared, they gave me both pleasure and instruction. I felt that there were points on which I should like to speak, but, like "Kiitik," was diffident of appearing to attack a first class forester like the author. My old and esteemed friend, N Hearle, has however broken the ice, but without noticing one point which seems of some importance. On page 12, Mr. Fernandez draws a comparison between the stock on the ground under the Gurnaud method, and the Uniform method, and proves vastly too much, for he would have us believe that in spite of various assumptions, all detrimental to the former, it yet comes out twice as productive as the other Credat Judaeus. Figures can be made to prove anything, especially when you have to assume most of them by analogy. I do not believe that it is possible for any method, even though advertised as enthusiastically as the divine Sarah Bernhardt herself, to double the production of any forest that has been properly managed on older lines. It is not always easy to show where the fallacy lies, but in the comparison in question, one can be found, namely, the Stock under the Gurnaud method is taken from yield tables for "a crop of moderate density", whereas M Gurnaud grows his crops so open that he can dispense with any area at all for producing trees up to 8 inches diameter. Now, an 8 inch tree is no chicken, by no means the *quantité négligeable* that M Gurnaud seems to think it. I am anxious to see the Gurnaud method, after a little sobering down, given a fair trial, say in Sal Forests, but as presented to us so far, it bears such a suspicious resemblance to the millenium that I am a little shy of touching it. Nor do I like the atmosphere surrounding it. When a responsible body decides, not without some hesitation, to give a pretentious but doubtful new comer a trial, it is scarcely the thing for that new comer to get on a tub and rant about scoring a victory over them And when a responsible body says one thing, it is scarcely sound argument to make out that it means something else. Such things are quite *de rigueur* in politics no doubt, but it is our privilege to belong to science. I sincerely trust Mr. Fernandez will not think I am aiming at him, for that is far from my desire, he has done good service in bringing us what he found in France, the good with the possibly bad, but we may discriminate between the materials brought, without being any the less grateful to him for bringing them.

It appears to me that M. Gurnaud claims more than his due. It may be the case that his method was evolved purely from a contemplation of the barbarities and horrors of the Uniform method but there were forests of mixed ages before Gurnaud, and he had excellent models to improve on. Uniform crops may likely enough devote too much space to the younger classes, and this one discovery, an important one, seems to me to be about the limit of M. Gurnaud's merit. For the rest, his method has considerable analogy with the various modifications of the Selection method, and essentially with the method of Storeyed Forest. So much so that in teaching the new method, I should do so as a variety of the latter. There is nothing new about the rejection of age-classes, we talk of age-classes, but in irregular crops we work by size, merely assuming, for our own information, that a given size corresponds more or less to a given age. In Storeyed Forest we have four or five classes, on equal areas. The exploitability of the largest class is when it reaches a given size, not age, the fellings in the other classes partake of the nature of thinnings, but in making them we look to the size, and not to the age, for information as to the class they belong to. The Gurnaud method has four size-classes, but pretends it has three, or at least only three that require any growing room. It is simply fudging of the most hap-hazard kind to say "grow the crop thin and let the youngest class find room where it can." This sort of prescription opens the door to all kinds of remarkable eccentricities in the degree of thinness It would be not only more scientific, but safer, to approximate to Storeved Forest by dividing the 8-inch class into two, by ascertaining the average area covered by an average tree of each, and by then stating the number of stems there should be in each, the area allotted to the smaller classes being duly diminished in whatever may be considered reasonable in accordance with Gurnaud ideas for the species and locality in question. In spite of the liberal allowance of assumptions of increments, optional amounts of fellings, and so on, (see page 15,) it does not appear that the Gurnaud method possesses any striking advantages in facility, accuracy, or safety, over half a dozen varieties of the selection method, or over the Storeyed Forest method. Its one and only strong point seems to be the reduction of the area allotted to the youngest classes, and unless further details are forthcoming, I should prefer to apply the method of Storeys, modified in this sense.

As to Gurnaud Coppice with Standards, it is an excellent instance of that "intense love of the French for mathematical symmetry," logical completeness, &c, which Mr. Fernandez has justly alluded to. The only notable point about Gurnaud coppice is the straining of terms. It is quite as neat a jest to argue that Coppice with Standards is really workable on Storeyed principles, or Selection principles, as to say that it can be appropriated by M. Gurnaud What is there in the method as ordinarily taught, to prevent us having our Standards in the proportion of 2:3:5 or of 4:6:8 or any other that may seem suitable. What prevents our pruning the standards if we are built that way. The thinning prior to felling is certainly not M. Gurnaud's property. The only thing that is, and that not absolutely, is the short rotation, which I hope he will keep as quiet as possible. On page 15, by the way, the last formula has apparently a printer's 'error. It should be $\frac{rVp}{100+rn}$ not 100—rn.

F. GLEADOW.

III.—OFFICIAL PAPERS & INTELLIGENCE.

India Rubber in Assam.

A brief account of how rubber trees (*Ficus elastica*) are grown in Assam By Mr. D. P Copeland, Deputy Conservator of Forests, Darrang Division.

1. *Ficus elastica*—The Indian rubber fig or caoutchouc tree, is indiginous to Assam, where it is found a dominant tree in the evergreen forests It requires an exceedingly damp atmosphere, and the best natural rubber trees are met with in the forests at the foot of the hills or on the hills themselves up to an elevation of Rs 2,500 feet

2 *Natural germination*—In its natural state the rubber tree starts from seed dropped by birds in the forks of other trees, often 20 or 30 feet or even more from the ground, where it germinates, and the young plant remains an epiphyte for years until its aerial roots touch the ground, as soon as this takes place the little epiphyte changes rapidly into a vigorous tree, throwing out numerous aerial roots which gradually envelope the tree on which it first began life and often kills it out

Having started life so high up it soon throws out branches which overtop the surrounding trees and the numerous aerial roots which fall from these and establish connection with the ground, in a few years enable it to dominate the forest growth around it

3 *Seed*—The seed of this tree is contained in a fig shaped fruit about 75 seeds being found in one good sound fig The fruit first begins to form on the trees in March and ripens from May onward to December On some trees the whole crop ripens and falls off by June, but as a rule the rubber tree has fruit on it from April right up to December, the figs forming, ripening and falling off the whole of the rains

After collection the figs have to be carefully dried and mixed with pounded charcoal, which preserves the seed for several months.

4 *Seed beds*—In the Charduar rubber plantation nursery, for a seed bed 40 × 3½′, two to three seers of pulverized rubber seed, 10 seers ash and 20 seers of vegetable loam or good soil, are well mixed in a half cask and spread evenly over the bed, and then lightly stamped down and watered Such a bed should yield with good germination, 2,000 seedlings and should be sufficient for putting out 100 acres of rubber planted 70 ×′35 The beds must be well raised and drained, the soil being prepared in the same way as for vegetable or flower seed If sown in boxes these should be put under the eaves of a house; if in beds light

removable shades must be put up to keep off the direct rays of the sun The shades should be removed during rainy or cloudy weather and at night

Light sandy loam is most suitable for seedbeds if the soil is stiff, charcoal dust should be mixed with it to make porous and prevent caking The beds or boxes must never be allowed to get dry

5 *Sowing* —This should be done exactly in the same way as for vegetable or flower seed which requires transplanting after germination The figs are broken between the hands As the seed is very minute the particles of the fruit are left with the seed and sown with it no attempt being made to clean or separate the pulverized figs In order to distribute these minute seeds evenly over the seed beds or boxes, a certain quantity of ash and soil is mixed with them

6 *Germination* —Germination takes place from the end of April to the end of rains Seed sown between October and January requires daily watering and screening from the sun, and will not germinate before the end of April or the begining of May but seed sown any time during the rains will germinate in a few days (from five days to a fortnight) It follows the best time for sowing seed is during the rains that is from June to September

The embryo appears on the germination of the seed as a seedling having a pair of opposite cotyledons with an entire margin destitute of incisions or appendage of any kind, with the exception of the notched or emarginate apex, oval in general outline, green in colour and of a glassy smoothness The second pair of leaves shew a tendency to the alternate arrangement on the stem but appear at the same time Their shape and venation are very different from those of the primary leaves for they have a central midril and a distinctly coarsely crenate margin The third pair of leaves do not appear simultaneously, and are distinctly alternate with a marked reddish colour After this the plant is easily recognized

7 *Pricking out* —When the seedlings are two inches high in the seedbeds or boxes they should be transplanted into nursery beds, and put out in lines about a foot from each other The nursery beds should be well raised and drained but the soil need not be so carefully prepared as for the seed beds Here the plants are kept till the following rains when they are dug up and taken to stockaded nurseries in the forests and put out 5 × 5 on raised well drained beds , where they remain for two years till they are required for planting operations

8 *Forest Nurseries* —Almost every animal will eat the young rubber plants, it is therefore impossible to plant out small seedlings in the forest owing to the destruction by wild elephants and game, unless each individual plant is carefully fenced in As this is too costly and the rubber after it is 1-2 feet in height is very hardy and

can be transplanted with ordinary care, at any time of the year (the best time in Assam is between May and July), the seedlings are kept in stockaded nurseries in the forest where planting operations are to take place, and remain there till they are 10 or 12 feet high, that is about three years after germination, when they are dug out and the roots are cut back 18 inches right around the plant and planted on the mounds in the forests

9 *Planting operations*—In artificial planting it is found that the rubber grows best on mounds Lines are cut through the forest 20 feet wide and 70 feet apart from centre to centre, in these lines 15 foot stakes are put up 35 feet apart Round each stake a mound is thrown up 4 feet high The base of the mound is about 10 feet in diameter and tapers to 4 feet on the top, on this mound the rubber tree is planted, care being taken that the roots are carefully spread out before they are covered up with earth To prevent animals pulling the plant and wind blowing them down they are tied to the stakes

10 *Cutting*—The rubber tree can readily be propagated from cuttings, if only perfectly ripe young branches or shoots are used, but the tree raised from cuttings does not appear to throw out aerial roots and as the future yield of the tree probably depends on its aerial root system it is questionable whether trees raised from cuttings ought to be used except where required only as shade givers, such as in an avenue In the Chardaar rubber plantation propagation by cuttings was given up very early, that is about 1876, the plantation having been commenced in 1879 The best time to take cuttings is May and June

11 *General*—The rubber grows equally well on high land or low land, in forest land or grass land so long as it is planted on a mound and its roots are not exposed to the sun It is a surface feeder, but as soon as its roots appear above ground they must be covered with fresh earth until such time as the tree has formed sufficient leaf canopy to protect itself

VI-EXTRACTS NOTES AND QUERIES.

Tan and Dye extracts from Ceriops Candolleana.

The Kew Bulletin for February and March, 1897, contains the following information in regard to Ceriops Candolleana, which is at present attracting a good deal of attention as a source of dyeing and tanning material

Letter from Mr H N Ridley, Director Gardens and Forest Department, Straits Settlement, to the Director Royal Gardens, Kew.

I am sending you a small box of extract of Tengah bark (*Ceriops Candolleana*) This bark is used here for tanning, and also for dyeing, especially in conjunction with Indigo The bark was cut up in bits and boiled for two hours in a copper pan, and the liquid eventually dried by heat

In dyeing it is used to give a brownish red color to cloth, but especially to get good black and purple The cloth is first dyed in Tengah, dried and then dipped in Indigo and comes out purple or black according to the strength used

The tree is very common here and used as firewood and the bark mostly wasted So it could be prepared at no great cost I should be glad if you would get an opinion on it it either as a dye or a tan

Mangrove extracts have I believe, been tried before, but have not been successful, because there has not been any attempt to discriminate between the species but all kinds of barks have been stewed up together and the result tried Now I am going to work through all the Mangrove tan barks one by one, and try if we cannot make some use of them

Note by Mr J J Hammond, Professor of Dyeing Yorkshire College Leeds

'Tengah bark extract behaves as regards its dyeing properties in a similar manner to a good quality of Catechu

When used along with Indigo as is apparently the practice, the latter is probably applied in a Copperas' (ferrous sulphate) vat, in which case the Tengah" will combine with the iron and produce as indicated above a grey colour, which in conjunction with the Indigo blue gives the black

Tengah extract would certainly be of value to dyers.

The Extraction of Gutta-percha from the leaves of the Isonandra Gutta-percha Tree.

Mr. Bourdillon has sent as a copy of an interesting report on the above subject by Professor W Ramsay, Ph D, F.R.S, of University College, London from which we make the extracts given below Could not a somewhat similar process be applied for extracting India rubber from the leaves of *Ficus elastica*? Perhaps some of our readers who are in charge of rubber forests would make experiments in this direction and let us know the results

' The existence of a gum of a plastic nature in certain of the trees found in the Malayan Archipelago was first indicated by Montgomery, in 1832, but it was not until 1847 that Mr Thomas Lobb sent specimens to Sir William Hocker The material extracted from this tree was named "Gutta-percha"—or the "Rag Gum," to translate the word literally, The word "rag" refers to the appearance of the gum before it has been kneaded into the usual compact form in which it is known in commerce In 1848 the material was patented as an insulator for telegraphic wires by Messrs W H Barlow and T Forster, and in the following year by Dr Siemens , so that its value for the purpose for which it is now in ever-increasing demand was early recognised In 1849 Mr. Walker Breit laid the first cable, two miles in length, in the English Channel It consisted of wire, insulated with Gutta-percha ; and at the present date, with the exception of a small consumption for bottles and stop-cocks to resist the action of strong acids, almost all the Gutta-percha produced is used to cover the wires of submarine cables But the supply is far behind the demand. There is in existence to-day no less than 162,000 nautical miles of cable, and in 1884 over 3 000 tons were exported to England, involving the destruction of 12,000,000 trees of thirty years old Owing to this great destruction of trees, the quantity of Gutta-percha in the market has been greatly diminished, and the price has risen accordingly, while the material is no longer of such good quality as it used to be Indeed, it is stated ("Le Caoutchouc et le Gutta-percha," by E Chapel, Paris, 1892) that the Chinese merchants are so much in the habit of adulterating the pure gum with resins from other species of trees, that it is not possible to find a pure specimen of Gutta in the market The gums from species of Euphorbia are frequently used for this fraudulent purpose."

"There is great need to increase the supply of genuine Gutta-percha , and there is every prospect that a rich reward would recompense a successful effort to do so "

"The present process of producing Gutta-percha is, as has already been indicated, wasteful in the extreme, and very costly. The trees are either ringed, so as to cause a flow of sap, or felled, and in either case the tree is destroyed Moreover the gum is mixed with impurities of vegetable matter, such as pieces of bark, and even with mineral matter, like sand and earth , to say nothing of the adulterations fraudulently added by the Chinese merchants. This necessitates a costly purification, which is achieved by softening and kneading the gum, or by squeezing it through wire gauze or some similar process, the results of which are, at the best, not very satisfactory Solution in bisulphide of carbon, or in benzine, has also been tried as a means of removing these impurities, but the quality is thereby deteriorated After the impurities have been mechanically removed, the gum is rolled between grooved or spiral rollers to expel water and air."

"The yield from a single tree, too, is by no means great. A tree of fifteen to twenty years old gives only three to three and three quarter ozs of Gutta, one of thirty years-old gives some nine ozs , according to Serullas ; and Burck gives about ten ozs. as the yield of a dichopsis tree twenty-six years old," "The juice as it flows from the tree is white, on standing, it solidifies spontaneously, forming a sort of pellicle on the surface. On boiling or heating the juice, the Gutta collects into a more or less coherent lump."

"The Gutta as it comes into the market has usually a brown colour, which, however, does not belong to the pure gum, but is due to a trace of colouring derived from the bark; in some specimens the colour is dirty-white or pinkish, but the pure gum is really colourless. After being kept in the air for some time, the gum changes spontaneously to a brittle resin; this change does not occur if light be excluded, nor is the gum changed by light if air be excluded. Under water it is quite stable, whether the water be fresh or salt. It is found, too, that specimens differ in their power of withstanding the action of the air, and it is believed that the purer the Gutta the better it will resist the action of the air. It is found, indeed, that pure Gutta is only slightly attacked even after a very long exposure to light and air."

"In what is usually termed "Gutta-percha" three distinct chemical substances are to be found. On boiling the gum with absolute alcohol a quantity of resinous matter is dissolved, varying with the specimen of Gutta employed. Even the purest gum in the Market yields some 18 to 20 per cent of its weight to boiling alcohol; and only what is left can be considered to be the chemically pure compound. Of worse varieties of gum, 40 or even 50 per cent. may be thus dissolved. These dissolved resins, although possessed of good insulating properties, cause the Gutta to deteriorate very rapidly if they are present in large amount; it becomes friable and easily disintegrated, owing to oxidation. It is their presence in poor qualities of Gutta which renders them unsuitable for telegraphic purposes. But up to 18 or 20 per cent, they do not appear to act injuriously The resins are named "albane" and "fluavile" respectively; the former, when quite pure, forms white crystals, the latter is a yellow gum. Both appear to be products of oxidation of the pure Gutta, albane containing twice as much oxygen as fluavile. Oudemans gives the formula of albane as $C_{20}H_{22}O_2$, and that of fluavile as $C_{20}H_{32}O$. But the chemical nature of these bodies, including Gutta-percha, has hardly been explored."

" M. Serullas has been led to devise a method of extracting these mixed gums from the leaves, instead of from the trunk of the Isonandra Gutta-percha. This tree used formerly to flourish in the Malay Peninsula in the neighbourhood of Singapore, but until it was re-discovered in 1887 by M. Serullas, it had not been utilised as a source of Gutta for thirty years, and it was supposed to have become extinct. It is the product of this tree which M. Serullas says is best adapted for telegraphic purposes, for it yields gums containing the highest percentage of pure Gutta, mixed with the smallest proportion of albane and fluavile."

"In the best Gutta, the following are the proportions of these constituents:—

Pure Gutta-percha ...	75 to 82	per cent.
Albane ...	19 " 14	"
Fluavile	6 " 4	"

"The process of extracting Gutta-percha from the leaves is an exceedingly advantageous one To quote from the *Sarawak Gazette*, of the month of April, 1895:—'A tree of twenty-five to thirty years old yields one catty (one and one-third lbs) of pure dry Gutta, the same amount can be obtained by two pluckings of the leaves." The *Gazette* goes on to say that the stumps of trees which have previously been felled have now become covered with shoots, bearing rich crops of leaves; and that M Hourant has induced the natives to collect these leaves, and that they are now exported in considerable quantity"

"M. Serullas states that a tree thirty years old yields 25 to 30 kilograms (55 to 66 lbs) of green leaves, or about 11 kilograms of dried leaves (24 lbs.), from which it is possible to extract, by methods to be described, no less than 1,000 to 1,100 grams (over 2 lbs.) of Gutta-percha, while the felled tree yields only 365 grams as a maximum. It would thus require that a tree should yield only 7 kilograms of fresh leaves per annum in order to give as large a supply as the whole tree felled, and with much less expenditure of labour."

"It now remains to describe the method of extracting the Gutta-percha from the leaves. The process is due to M. Serullas.

"The leaves, either fresh or dry, contain Gutta-percha. The process of drying, whether artificial or natural makes no difference to the percentage of Gutta if the latter be reckoned on the dry leaves The leaves, after being dried, are ground to a fine power, and then mixed with one-tenth of their weight of caustic soda dissolved in water, and heated to boiling, or indeed digested under a slightly increase pressure The liquor turns dark brown in colour, owing to the solution of a brown colouring matter, to which the Gutta-percha which usually comes into commerce owes its colour. The weight of the leaves, and also their bulk, is materially decreased by this process. The powder is then dried by heating to 212°F; a solvent is added, in a closed vessel, so as to hinder loss by evaporation. The mixture is heated so as to effect the solution of the Gutta-percha more quickly. The mixture is placed in a filter press, and the solvent is separated as completely as possible. The residue of leaves is washed with fresh solvent so as to extract the whole of the Gutta. The solution is of a greenish-brown colour, owing to the solvent dissolving out some chlorophyll—the colouring matter of leaves. As some solvent remains adhering to the powdered leaves, a current of steam is driven through this residue, which carries off the solvent and permits of its recovery The extract is next placed in a still, and the solvent is partly removed by distillation, the pressure being somewhat reduced, so as to cause its boil at a temperature lower than that of boiling water The concentrated extract is then run into a tank and mixed with twice its bulk of a volatile liquid. On mixing this liquid, which is done in a closed tank, there is produced a flaky or "raggy precipitate of Gutta-percha. This precipitate is filtered off again by means of a filter press and the mixed liquids are run into a retort where they are submitted to distillation and are thus separated"

"The cakes of Gutta-percha from the filter-press are dried at a low temperature, they are then heated so as to soften them, and in presence of water they are moulded into lumps"

'The process is thus seen to be a very simple one The products are easily prepared, and there is no loss except the unavoidable one, which always occurs when any substance is put through a round, and which is unlikely to be considerable"

The next question is as regards the yield of Gutta-percha from the leaves and twigs The following table is extracted from the valuable work on "Caoutchouc and Gutta-percha," by Seeligmann, Lamy, Torrilhon, and Falconnet, published by Britach, of Paris, 1896 —

"Old dry wood	10	per cent.
"	9 15	"
'Dry twigs	10 20	"
"	10 50	"
'Dry leaves	10 02	"
" imperfectly dried	9 06	"
" imported in water	10 05	"
" " "	9 00	"

"I have myself extracted Gutta from the leaves of the tree, by the process of Serullas, some six or seven times Even on a small scale where the difficulties of extraction, filtration, &c, are much more considerable than on a larger, I have obtained a theoretical yield The following is a typical analysis of a sample of leaves, chosen at random from among many —"

Water in the naturally dried leaves	19 92 per cent.
Extractive matter removed by caustic soda	55 00 "
Gutta, reckoned on the thoroughly dried leaves	9 61 "

"The statements made by M Serullas are therefore thoroughly borne out"

The following letter from the Director, Gardens and Forest Department Straits Settlement, to the Director, Royal Gardens, Kew which is printed in the Kew Bulletin for May and June 1897, gives a somewhat different account of the process "I have just been to inspect the little factory where Mr Arnaud makes his gutta percha. Serullas has gone back to Paris with endless patents of different kinds, and Mr. Arnaud alone keeps up the business. The leaves are imported in sacks dry, from Borneo and Johore. Most of the trees are overcut in Singapore, and there are no more leaves left, I hear. The leaves and twigs cost four dollars and half a picul (133 lbs). They are then put, damped with hot water, into a rolling machine, two rollers working 'against each other, which grind them to powder. The powder is thrown into tanks of water and shaken about. The gutta floats in the form of a green mealy-looking stuff, is lifted out by fine copper gauze nets, put in warm water and pressed into moulds. I have samples of the gutta as it comes from the leaves, and the pressed out finished article. It is really a very curious little manufactory I do not know how long it will last, on account of the difficulty of procuring leaves, which must, I think, sooner or later stop the trade."

Siamese Forests.

In the course of Mr. Beckett's report on the trade of Chiengmai he says :—The whole question of forest leases and of forest conservancy has been closely studied during the year by a Conservator of Forests lent by the Government of Burma. In view of the fact that nearly three-fourths of the teak timber industry is worked by British capital,, the objects aimed at by the Conservator and the measures already taken are worthy of special notice. His objects briefly are these—(1) to limit the areas worked; (2) to increase the girth and therefore the age at which teak trees may be felled, and to prohibit the indiscriminate felling of trees less than 4 soks (6 feet 6 inches) in girth at the base; (3) to avoid depletion in the near future and provide for a sustained annual yield by dividing the whole teak-bearing area into a fixed number of sub-areas, each to be worked over at fixed intervals of time ; (4) to secure a fixed revenue to the owners of the forests and the Government of Siam by the payment of royalty in the case of the Salween forests at Moulmain and of the Menam-floated timber at Chainat. The revenue derived hitherto from this source has, owing to the irregular collection of royalty by local administration proved but a fraction of the total due ; (5) to forbid the working of any forest without a lease and to refuse the grant of any further leases, and in such leases as have been given to exchange the old for a new form embodying the objects above-mentioned and introducing other special conservancy clauses.

Amongst the more important measures taken are the introduction of a new lease and of the new arrangement as to payment of royalty. Seven leases only were given in the old form adopted at the end of the year 1895, the first lease being dated the 7th December, 1895, and the last the 29th July, 1896. The point of resemblance between the old and new leases are—(1) all leases are to be for a term of six years; (2) royalty is at the rate of Rs. 4 for a log for Menam-floated timber, and Rs. 8 for Salween timber; (3) registration of property hammer-marks at the usual fee; (4) lease liable to cancellation by a competent Court for any breach of its conditions.

The most important feature of the new lease is the division of the lease into two parts; the first containing four clauses signed by the owner of the forest and the lessee, and the second 15 clauses containing the conditions regulating the conservancy of the forest leased, on which the Government of Siam by the Siamese High Commissioner agree to recognize and ratify the lease.

In the first part are the following new provisions:—(1) No conversion of timber until royalty has been paid. (2) Extension of period of lease, if necessary for removal of timber unextracted and lying in the streams. (3) No girdling of teak during 12 months immediately preceding the termination of the lease.

In the second part the most important new restrictions are—(1) Increase of girth from 6 kam (25½ inches) to 9 kam (38¼ inches). (2) Teak trees to be girdled at least two years before felling; (3) No teak tree to be girdled unless there is another teak tree in the vicinity able to cast its seeds on the ground covered by the tree to be felled; (4) A fine for each tree so damaged in felling as to be not worth extracting or at lessee's option payment of royalty and duty. (5) A fine for each teak tree consumed or damaged by fire before reaching Paknampho. (6) Permit-holder and lessee to be jointly responsible for all fines and penalties inflicted under the lease (7) The Minister of the Interior to have the right of closing the forest or any part of it for sylvicultural purposes. (8) Option of the Forest Officer to claim all rejected logs on repayment of royalty paid by lessee on such logs.

These new conditions have been accepted *in toto* by the two large British teak-trading companies and their example is being followed, though somewhat tentatively, by the Burmese and Shan foresters. The conditions are generally approved of as removing numerous vexatious clauses as to the registration of elephants, overseers, &c., but I have received complaints from the foresters and contractors as to the hardship to them, of the terms, as to the fine for damage in felling, the right to close the forest at any time for sylvicultural purposes, and the option of the Forest Officer to claim rejected logs. They would also prefer to have the extension of time for removal of logs fixed in all cases to 24 months and not be left to the discretion of the Conservator of Forests.

These few clauses are doubtless hard upon foresters, but since the object of the new lease is to render the extraction of teak more difficult, the insertion of these clauses can hardly be called a real grievance. The effect of the new lease will be to throw the timber industry more and more directly into the hands of the companies with large capital and out of the hands of the Burmese foresters

For the coming six years at least British traders may rely on an undiminished output After that period there may be falling off in supply owing to the more restricted areas and more stringent regulations But with considerable forest-areas in the provinces of Nan and Phre still scarcely touched, except in an irregular manner under a system of permits given by the local chiefs, and with the prospect of a further yield in future from forests now to be secured against entire depletion, the British merchant need not have cause for alarm.

There was no increase in wages of Khamus until the end of the year when they rose from Rs 50 for the first and Rs 60 for the second year's engagement for each Khamu to Rs 70 and Rs 80 or even Rs 90 which was still further raised, Rs 5 owing to the establishment at the commencement of 1897 by the French agent, of a fee of that amount per man per annum The supply is irregular and inadequate for forest requirements On a rough calculation there are some 4,000 Khamus now engaged in timber work. These men stay only two years in Siam and then return perhaps for a year or longer to their homes in Luang Prabang province They come inexperienced in the difficult craft of felling teak timber, and if trees are not to be damaged in felling, as stipulated in the new forest lease, some other source of labour will have to be discovered.—*Rangoon Gazette*

The Forest School Athletic Sports.

The Annual Fixture was brought off on Friday and Saturday, the 15th and 16th October, and was graced by all the beauty and aristocracy of Dehra, European and Native, besides a good deal that was apparently neither beautiful nor aristocratic The absence of nearly all our Garrison, the 2nd P W O Gurkhas, on service was much regretted

The first day was devoted to first heats but there were only two races, and the long jump in which the entries were numerous enough to necessitate the process of elimination so the cricket ball was decided outright, thus leaving a comfortable programme for the next day This event was won, as last year, by R R Fouracres, with a throw of 279 feet the native's prize being taken by Narasappaya, with 250 feet.

The 100 yards flat race for native students was run in two heats. The first was won by Govind Rao Sapre, in $12\frac{3}{5}$ secs with Mulraj in attendance The second heat went to Govinda Menon, in $11\frac{4}{5}$ secs, followed by Mahanand These four were thus left in for the final.

The hurdle race, 120 yards, open to the whole school, was also run in two heats. The first was won by D. A. Allan, in 18 secs., with C. A. Clerk next. The second heat went to Fouracres in 18-$\frac{2}{5}$ secs. with Purkis next. These four were consequently left in the final. This first day was ended, and the second well (or ill) begun by a dance very generously and kindly got up by some of the residents of the station, for the special benefit (?) of the students.

The second day's proceedings began with a flat race, 100 yards for native students. It was won by Govinda Menon, with Govindrao Sapre second in 11 $\frac{4}{5}$ secs. The next event was the long jump, in which J. Brown cleared 18 feet 11 inches, and Fouracres 17 feet 5½ inches. Govinda Menon was the best of the natives, taking the prize with less than his first heat leap of 15 feet 9½ inches. Mul Raj only did 13 feet 9 inches, but would do a great deal better with practice.

The next event was the open flat race, 100 yards. It was won by R. R. Fouracres in 10 $\frac{4}{5}$ secs., G. F. Matthews being about a yard behind. The hurdle race for native students, 120 yards, over 10 flights, gave rise to some excitement, and was won by Govinda Menon in 22 secs., with Mul Raj close up. The high jump was then brought off, the best being F. Edwards, with 4 feet 10 in. The prize for natives was taken by Govinda Menon, who jumped in fine style and was not far behind. The next event was one in which a good deal of interest was taken, namely, the open hurdles, and it produced a first rate competition. The winner was D. A. Allan, in 17 $\frac{1}{5}$ secs., with Fouracres and Purkis well up. The win was a very popular one, for the junior class which Allan represents, has but few Europeans to emulate the records set by their seniors, and maintain the School's reputation in the branch of sports. A flat race, 100 yards, for school and forest servants was won in excellent time by an outsider who slipped himself in among the competitors and was duly disqualified after setting the race in high class style. The half mile was the last of the races proper, and was not the procession that these long races often are. It was won by F. C. Purkis in 2 min. 25 secs., Fouracres taking second prize. The final events was the tug-of war, seniors *v.* juniors. The latter made a gallant struggle, but were nevertheless pulled over twice. The prizes were then distributed by Mrs. Gradon, each recipient being heartily cheered. In the unavoidable absence of the Director on duty, the Deputy-Director in very few words, thanked Mrs. Gradon for distributing the prizes and the visitors for having so greatly contributed by their presence to the pleasure and success of the meeting, which then closed by the students giving hearty cheers for Mrs. Gradon, the visitors, staff, &c. The usual arrangements were made to keep the ground by a detachment of Police, but nothing less than a 10 foot wall would convince a Debra crowd that there was any place closed to it.

A Menace of Treelessness.

Generally speaking, says a writer in the "New York Tribune," the growth of American industries is cause for satisfaction. To be able to say that exports of some leading commodity are now 25 per cent. greater than a year ago, and 100 per cent. greater than ten years ago is highly gratifying. Yet exceptions to the rule are quite conceivable. If it should appear that the growth of trade in any important product was tending to exhaustion of native resources and consequent domestic embarrassment and disaster, the circumstances would give rise to apprehension rather than pleasure, and economical wisdom would suggest the direction of efforts toward the restriction of that industry or toward such modification of it as would avoid the evil results threatened That is the case at present with the lumber trade. It is a legitimate and important industry, and one that should be so cherished as to insure its profitable permanency. But it is now growing at a rate which threatens in the near future its own self-exhaustion and the reduction of this country to the deplorable and ruinous state of treelessness. The facts cannot be concealed and should not be ignored. Throughout all the older States of the Union forests have long since practically disappeared. Only a few straggling and stunted remnants remain of the superb sylvan growth that once clothed every hillside. The effect is apparent. Streams that once flowed constantly the year around, are now overflowing torrents for a few weeks and dry for months. Springs have dried up Soil has become arid and sterile. Droughts are more frequent. Agriculture is less profitable. The evils that afflict the treeless countries of the Old World are beginning to be felt. Nor are the newer States of the Far West exempt. Their abundant forests are disappearing like snow in springtime, and in their place are coming changes of climate, disturbances to the water supply and the whole train of evils that forest-destruction inevitably entails.

It is idle to point to the vast expanses of untouched woodland that still remain, and boast that they are inexhaustible. They are not inexhaustible. On the contrary the time when they will all have been destroyed is now within measurable distance. It is easily within the lifetime of men now living. This year, as already stated, our exports of lumber are about 25 per cent. greater than last year, and 100 per cent. greater than ten years ago. Even at the present rate of cutting, the forests would not last long. But at such an increasing rate their disappearance is startlingly close at hand. Nor is that all. The figures cited are only those of exports. Domestic consumption is increasing still more rapidly. The single item of wood-pulp for paper manufacture means an enormous destruction of timber never dreamed of a generation ago. The lumber industry cannot, of course, be abolished Tree-cutting must continue But it is high time such regulations were adopted and rigidly enforced as will prevent the utter destruction of forests. This is entirely possible Not the mere amount of lumber cut, but the amount destroyed, wasted by careless and injudicious methods, is what most counts Every one who has visited a great lumber camp knows that more material is destroyed than is sent to market. The smaller trees not large enough for marketable timber, are regarded as mere incumbrances to be slashed and burned and got out of the way in whatever fashion may be readiest The ground is thus entirely cleared The great beds of moss and leaf mould, hitherto perennial reserves of moisture, are dried up The soil and rocks are exposed, and the country transformed into a desert. What should be done is evident The small trees should be carefully preserved, so that they may in turn grow to full size, and meantime shade the ground and preserve the forest conditions. Lumbering should, in brief, mean a judicious thinning out, not a wholesale destruction, of the forest. Tree planting should also be practised on an extensive scale, forest fires be more scrupulously guarded against and the woodland area of the country be systematically cultivated instead of ruthlessly raided Other nations neglected the lesson long, but have learned it at last, and now enforce it with a strictness that here might seem despotic. But this nation is bound to come, sooner or later, to some such system of forest conservation, and it will be fortunate if it does not reach it through the ruinous experience of treelessness

Kino from Myristica malabarica.

An astringent, red, resinous substance obtained from the sap of various trees of tropical countries is known as Kino. The best medicinal kind which contains 75 per cent of tannic acid comes from the Indian Kino tree *Pterocarpus Marsupium*, Roxb, while Bengal Kino is obtained in the form of round tears of an intense ruby colour from *Butea frondosa* Kino is usually used in medicine for its astringent properties in cases of diarrhœa, chronic dysentry, &c.

Among the various specimens obtained for the museum of the Royal Gardens from the International Forestry Exhibition held in Edinburgh in 1884, was a peculiar dark resinous substance labelled "Kat jadikai" or Kino obtained from *Myristica malabrica.* It formed part of a collection of products made by Mr. Rhodes Morgan, District Forest Officer, Malabar.

In appearance the substance is very much like that obtained from *Pterocarpus Marsupium*. It has since been examined by Professor Edward Schaer, of Strasburg, who has communicated an interesting account of it to the Pharmaceutical Journal (4th series Vol. III p 117), from which the following extracts are taken:—

"Professor Warburg, of Berlin, has kindly forwarded to me a sample of an extract or secretion resembling official Kino which with well known liberality had been put at his disposal by the Director of the Royal Gardens, Kew. The sample in question is labelled Kat jadikai, that is to say cutch like product of jadkai (Tamil name for *Myristica*), and known to be produced by incisions in the bark of *Myristica malabarica*, Lam, in Southern India, showed in its exterior appearance more direct analogy to the well known Malabar Kino than to the 'Kats' of *Acacia* (Cutch) or of *Uncaria* (Gambier) It consisted like official Kino of smaller or larger angular transparent pieces of deep garnet colour in thin fragments It was not altogether unlike small broken dragon's blood in some respects, and the latter name has been used sometimes by natives and merchants for some kind of Kino (from *Pterocarpus indicus* and *P. erinaceus*)

"Not having been acquainted before that time with kino-like products from the genus *Myristica*, and following the suggestion of Professor Warburg, who was then preparing a monograph of the Myristicaceæ, I at once proceeded to a closer examination of the new substance, availing myself of the latest observations concerning the natural history of the different kinds of Kino, especially of the drug derived from *Pterocarpus Marsupium* (Malabar Kino). Not only on its external appearance but also in its behaviour to water and other solvents, the 'Kat Jadikai' or kino from *Myristica malabarica* agreed almost entirely with *Ptercarpus* kino, giving a reddish, slightly turbid solution of feebly but perceptibly acid reaction to litmus paper The other physical qualities, for the most part proved to be the same as those described by Hanbury and Fluckiger (*Pharmacographia* II Ed. 1879, p 195) The same may also may be stated concering the more important and characteristic chemical reactions when compared with the chemical behaviour of official kino"

Professor Schaer thus summarises the result of his investigations into this and some other kinds, the produce of species of Myristica.

I The dried juices of the bark of several Asiatic species of *Myristica*, for instance *M malabarica* Lam, and *M. fragrans*, Houtt, as regards their appearance and physical qualities, show but little difference from the official Malabar Kino

II. These substances, which may be termed Myristica Kinos, agree in the chemical reactions due to their constituents, in all important points, with the Kino of *Pterocarpus Marsupium*. It can therefore be stated that drugs of a very similar character, and partly of close resemblance to official Kino, are to be found in the families of Leguminosæ (*Butea*, *Pterocarpus*, *Millettia*), Saxifragaceæ (*Ceratopetalum*), Myrtaceæ (*Eucalyptus*, *Angophora*), and Myristicaceæ

III. The *Myristica* Kino differs, as far as can be observed from the *Pterocarpus* Kino, and probably also from *Butea* and *Eucalyptus* Kino, by containing, in the crude state of the inspissated fresh juice, smaller or larger amounts of a distinctly crystalline calcium salt, *viz* calcium tartrate, suspended in, and depositing from, the liquid juice By this characteristic admixture it can be easily distinguished from the official Kino, and probably also from other Kinos of commerce

Whether this new substance might ever be obtained in combination with the production of nutmegs and mace, so as to play the part of a commercial drug, will depend upon a still better knowledge of its qualities, its formation in the living plant, its quantitive relations and similar questions.

KEW BULLETIN.

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

4th October, 1897.

EAST INDIA TEAK.—There is no change to report in the market for this wood in London. The deliveries are small for the month, 1,289 loads against 2,481 loads in September last year. The figures for the first three quarters of 1897 are 13,157 loads against 16,264 loads in the same period of 1896 The engineers strike is affecting the trade in teak for the time by cutting down the main source of demand in Great Britain. The ground being lost cannot altogether be made up, although a settlement might well result in a special demand for accumulated arrears A continuance would soon divert this demand to foreign ports.

ROSEWOOD—EAST INDIA.—Is asked for and small lots of good logs would sell well.

SATINWOOD—EAST INDIA—sells very slowly, and there is a considerable stock in hand

EBONY.—EAST INDIA.—Good wood, in small lots, would realise fair prices.

PRICE CURRENT.

Indian teak	per load	£10 10s.	to	£15 10s.
Rosewood	„ ton	£8	to	£10
Satinwood	„ sup. foot.	5d.	to	12d.
Ebony	„ ton	£7	to	£8

Denny, Mott and Dickson's Wood Market Report.

LONDON, 1st OCTOBER, 1897.

Teak.—The landings in the London Docks last month were 1,455 loads as against 2,626 loads for the corresponding month of last year; whilst the deliveries from the Docks into consumption were 1,288 loads as against 2,309 loads delivered in September, 1896. The London stocks now analyse as follows:—

	10,505	loadsof logs,	as against	8,655 loads	at the same date last year.
	2,415	„ planks,	„	2,338	„ „
	15	„ blocks,	„	112	„ „
Total ...	12,985 loads		„	11,105 loads„	„

The deliveries have been disappointing, as London has not been so seriously affected by the engineers' strike as the shipbuilding centres. Indifferent wood continues to accumulate, and may give trouble to realise; but the very moderate stocks of wood of good quality not only continue to fetch high prices but practically monopolise the demand for rolling-stock purposes, which, since the troubles in the shipbuilding industry, has been the chief outlet for teak.

The figures for the past nine months, however, show a marked falling off, both in imports and consumption, *viz*:—

13,902 loads imported into the Docks from 1st January, to 30th September, this year, against 17,607 loads for the corresponding period of last year.

And 12,839 loads consumption 1st January this year to date, against 16,301 loads for the corresponding nine months of last year;

showing a reduction of about 21 per cent. on the imports, and, rather curiously, the same in the consumption. The imports would have shown a very alarming falling off had not wood of bad quality been shipped to fill up the gap; and the natural objection of consumers to such low class wood probably accounts for the falling off in consumption, as the rolling-stock industry has been quite as active this year as last.

Planks have been in good demand, although the proportion of inferior importation continues, as in the case of logs, to increase.

A noticeable feature of the market has been the maintenance of a good standard of quality in the shipments from Bangkok, which has greatly helped to dissipate the prejudice which the recklessly bad shipments of some years back had caused. Many good judges now prefer the well-converted straight and good cube Bangkok logs to the increasingly crooked, badly converted and smaller cube logs from Moulmein and Rangoon, whatever may be claimed as to the milder and better texture of the wood grown in Burmah. It is certain that the Burmah shippers must take more care with their shipments if they seek to maintain the old preference.

MARKET RATES OF PRODUCE.

Tropical Agriculturist, October, 1897.

Cardamoms		per lb.	3s.	to	3s. 1d.
Croton seeds		per cwt.	50s.	to	60s.
Cutch		„	9s. 3d.	to	32s. 6d.
Gum Arabic, Madras		per ton.	20s.	to	55s.
Gum Kino	„	„	£45	to	£55
Indiarubber,	Assam	per lb.	1s. 9d.	to	2s. 4d.
„	Burma	„	1s. 4d.	to	2s. 1d.
Myrabolams,	Bombay	per cwt.	4s. 3d.	to	9s.
„	Jubbulpore	„	4s.	to	7s.
„	Godavari	„	3s. 9d.	to	5s. 6d.
„	Calcutta	„	3s. 6d.	to	5s. 6d.
Nux Vomica, Good		„	7s.	to	7s. 6d.
Oil, Lemon Grass		per lb.	2⅝d.		
Orchella, Ceylon		per cwt.	10s.	to	12s. 6d
Sandalwood, logs		per ton.	£30	to	£50
„	chips	„	£4	to	£8.
Sapanwood,		„	£4.	to	£5.
Seed lac		per cwt.	70s.	to	80s.
Tamarinds (Madras)		„	4s.	to	6s.

THE

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Nitrogen and Forest Crops.

Forest trees are little behind agricultural crops in their demand for nitrogen This element, in association with carbon and water, forms the varied and important group of proteids, comprising, among other things, the fundamental basis of every living cell, namely, protoplasm Accepting the figures of the Bavarian foresters, a beech forest, for instance, may produce annually 3 000 kilogrammes of wood and 3,000 kilogrammes of leaves, dried at 100°C. The 3,000 kilos of wood contain 15 to 25 kilos of nitrogen, since this element constitutes from 5 per cent to 8 per cent of the whole The leaves also, when they fall will contain 30 kilos of nitrogen or thereabouts, hence, unless the nutrition and consequent production of the forest are to diminish some 45 to 55 kilos of nitrogen, per hectare must be forthcoming to make up the loss In agriculture, there is an essential difference, in that field crops have in general a greater need for nitrogen, and return little or nothing to the soil, while the forest, at the close of each growing season, returns to the soil in the form of dead leaves the greater part of what it has borrowed Field crops leave behind little beyond their roots, and in the case of turnips, beet, &c not even this Hence the necessity of applying green manures stable litter, nitrates, ammonia salts, &c, to obtain a continued fertility Soils like the black earth of Russia, which need no manure, are extremely rare A forest is never manured, but in spite of the continual loss of nitrogen by decomposition and by the removal of wood, vegetation flourishes indefinitely, and the soil becomes even richer in nitrogen, as is seen in the re-clothing of bare areas What then are the causes which bring about a gain instead of a loss ? The question of manures has raised the most lively and still undecided controversies in agriculture, but forests are on a somewhat different footing, and require separate consideration

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* 1 Translated by F Gleadow from an article by E Henry, in the 'Revue des Eaux et Forêts

Gains The forest soil may gain nitrogen —

1 By the plants or soil abstracting it from the air or from rain, &c

2 By deriving it from matters returned to the soil by plants or animals

3 By the fixation of gaseous nitrogen, either by living plants, or by dead organic matters, or by the soil

There seem to be no other possible causes of increase in the quantity of combined nitrogen

Losses The soil loses nitrogen —

1 By the removal of the plants or wood produced As already stated, this consumption is about 50 kilos of nitrogen per hectare, per year, of which about 20 kilos are removed as wood and do not return to the soil

2 By the amount of combined nitrogen carried off in drainage water

3 By the amount of combined nitrogen which decomposes and returns to the air in the gaseous state

There seem no other possible causes of loss On balancing these two accounts, it will be seen whether the soil has become richer or poorer in this important but scarce constituent Chemical analyses made at sufficient intervals will be of great assistance Let us examine first the losses These are caused principally by the removal of wood Of the two other causes, the loss by drainage waters does not occur in forests because of the absence of nitrification in forest soils It is only nitrates that are carried off in drainage water It is in fallows and in fields, especially after manuring, that the loss by this cause is greatest

In 1895 M Deherain found, in the water drained from four plots, from 110 to 130 grammes of nitrogen in the nitric state, per cubic metre From these figures, combined with those representing the variable quantities of water drained off more or less as the soil had been more or less worked, he concluded that 84 to 144 kilogrammes of nitrogen per hectare were carried off by drainage Nothing of the sort happens in the forest, where I have satisfied myself that even on limestone soils there is no nitrification

On the 20th May, 1897, I took 10 samples of soil from neighbouring spots, some in forest, others in the open. Of each, 30 grammes were triturated in 25 cubic centimetres of distilled water After a day's maceration, one or two drops of the solution, let fall into 4 drops of sulphate of diphenylamine, will produce a blue cloud if there is but a trace of nitrates This reaction is extremely sensitive If one centigramme of nitrate of potass be dissolved in a litre of water, a single drop of the solution let fall into the 4 drops of diphenylamine produces almost immediatly a bright blue cloud

Three samples of soil taken from a bare place in the Bellefontaine nursery, not having been manured for two years gave the reaction distinctly Two samples, taken 50 yards off, in the forest, under a high polecrop of beech, showed no sign of nitrates. A sample taken inside the nursery itself, soil covered with matted grass, &c, but sheltered by an old beech, gave no sign, neither did two samples, taken from the woods of M Hinzelin On the other hand, two samples, one taken from a fresh ploughed field below the nursery, the other from near Maxéville, gave distinct indications Boussingault during his fine study of nitrification, long ago remarked the want of nitrates in the forest soils of Alsace Ebermayer also, the eminent Munich Professor, in 1888 published an important paper "on the nitrates in forest soils and trees" "The examination of more than 100 samples of soil, from ' as many different spots, mostly in the mountains of Bavaria, showed that forest and peaty soils are nearly or entirely free from ' nitrates while field and garden soils manured with night soil, ' stable litter, liquid manure, &c, are all rich in this valuable ' plant food Even the black earth, which is sometimes found in ' considerable thickness in certain forests of the Bavarian Alps, is ' almost entirely free from it Thus, according to Ebermayer, the ' microbe of nitrification is not found in forest soils or peats ' In other words, in all soils whose humus is of exclusively ' vegetable origin the general conditions are quite opposed to ' nitrification, and the decomposition of the nitrogenous principles ' of vegetable matter seems limited to the formation of ammonia—" ' (Grandeau)

M Bréal also has reported that there are no nitrates in the soil either of forests or of meadows As nitrification requires the presence in the soil of alkaline substances, the absence of the nitric ferment might be due to the want of lime or to the acidity of the forest soils examined Therefore I thought it desirable to repeat the experiment in the Forêt de Haye where the surface soil is very thin, rests immediately on limestone, and has but a poor covering of dead leaves If nitrification is not found in such a forest, it is found in none The first trials were negative but too few to be final. I shall therefore take up the question again at the end of the summer, when the season is most favourable to the progress of nitrification

If nitrates are not formed in forest soils, it may perhaps be due to the presence of other ferments which reduce the nitrates as soon as they begin to form M M Gayon and Dupetit, Dehérain and Maquenne, have proved that, in a reducing atmosphere, the decomposition of nitrates is brought about by microscopic organisms, which they have called *Bacillus denitrificans* because they act in a sense contrary to the *Bacillus nitrificans*, which produces nitrification. M. Bréal has shown that these denitrifying organisms, which exist in straw, and doubtless in all vegetable *débris*, decompose nitrates, partly by forming organic compounds, and partly into gas which is dissipated in the air. M Bréal says that

" in the soil of permanent meadows and of forests, where there is so much dead vegetable matter, this aerobic nitrate-reducing ferment must be plentiful and an obstacle to all nitrification " Further, all experimenters agree that in nitrification, that is to say, in the transformation of ammoniacal salts or of primary amines into nitrates, there is a constant evolution of gaseous nitrogen if oxygen is in excess Thus whether, there is nitrification or not, a part of the combined nitrogen, the exact amount not being easily determined, disappears as gas, without profit to the crop

The causes of loss then are two One which is considerable, amounting to a score of kilos, results from the removal of the crop The other, less important, but uncertain in quantity, is the disappearance into the atmosphere of some of the nitrogen which in its various tranformations attains the gaseous state

We now come to the causes of gain The first is the combined nitrogen brought to the plants or soil by the air or by rain, snow dew, fog, &c Liebig, Boussingault, and others have shown that these natural elements contain ammonia and nitric acid Boussingault found in rain from 0 11 to 3 49 milligrammes of ammonia per litre In 1853, the mean was 0 42 mg of ammonia, and 0 18 mg of nitric acid Fog contained, when condensed to a liquid, from 2 56 to 49 1 mg of ammonia per litre At six German stations the amount of combined nitrogen in rain varied between 0 29 and 13 mg per litre The quantity varies with the locality and the year Messrs Lawes Gilbert, and Way estimated the combined nitrogen received per hectare at 8 kilos per annum At Proskau, the amount was 23 kilos at Regenwalde 17, at Insterbourg 6 2, at Kuschen 2 1 These quantities, though varying widely are always small There is also in the air a very small amount of carbonate of ammonia, which can be absorbed by the leaves or by the soil as shown by Sachs, Schloesing, Mayer and Muntz Schloesing found, as a general mean for a whole year, 2 25 mg of ammonia in 100 cubic metres of air, Muntz found the same His experiments, begun in 1886 and ended in 1895, show that vegetable juices, whether acid or alkaline, absorb ammonia with as great avidity as a 2 per cent solution of sulphuric acid does up to saturation point Living leaves have only 3 to 5 per cent of the absorptive power possessed by vegetable liquids, and M Muntz draws the conclusion "that agriculture 'cannot expect any great assistance from atmospheric ammonia 'Some, indeed, is received, but no more than is derived from the 'ammonia and nitric acid absorbed from the air by rain We 'shall not be far from the truth in estimating the sum total of 'these sources at 5 to 6 kilos per hectare " It is certain that though the ammonia brought down by rain is not appropriated by the leaves, it is none the less absorbed by the soil, equally with potass and phosphoric acid, not an atom is lost In the case of nitrates, we cannot be so certain Nevertheless, seeing the scarcity of these salts in forests, and the avidity with which plants take them up, it is probable that the whole is utilised The absorptive power of the soil for ammonia is such that it takes up not only what is brought by rain, but also that contained in the air, derived principally, according to M Schloesing, from marine evaporation M Schloesing's ingenious ideas on the circulation of combined nitrogen over the surface of the earth are well known. M Schloesing's experiments on dry and moist earths, with and without lime, have shown that the soil takes ammonia from the air, and yields none to it Dry earth incapable of nitrification naturally absorbs less ammonia than moist earth, in which, during the summer nitrification is incessant , in the latter, the ammonia is continually transformed into nitrates the tension is never in equilibrium, and the earth is always ready to absorb alkalies from the air to an indefinite extent Consequently the absorption is only limited by the rapidity of nitrification

In a month and a half from the 1st August to the 15th September 1875, two lots of fine dry earth not favorable to nitrification exposed to the air, but sheltered from rain, increased their percentage, the soil with lime from 0 747 mg to 2 504 the soil without lime from 0 219 to 4 145 mg The absorption is necessarily limited by the equilibrium of tension in this case but it is otherwise with a moist soil, favorable to nitrification M Schloesing found that the hectare in 14 days took up 2 590 kilos, and again in 18 days 4 097 kgm or for the first soil at the rate of 63 kgm and for the second 53 kgm , per annum But as nitrification only goes on in summer, these figures must probably be reduced to half But we need not concern ourselves much with this point, since we have seen that there is no nitrification in forests Even when moist, and in the height of summer forest soils always behave like dry bare soils, so that in forests we have only from 5 or 6 kilos (Muntz) to 10 or 15 kilos (Berthelot) received per hectare, whether through direct absorption of gaseous ammonia, or through rain, &c This quantity is quite insufficient to make good the 20 kilos of nitrogen removed in the wood, and the loss through the return to the gaseous state of part, of the combined nitrogen in the soil If there were no other sources to make good the loss, the forest soil would become continually poorer, which is not the case There must then be other sources Before it had been ascertained that certain plants have the power of fixing atmospheric nitrogen in their tissues, it was held according to M Schloesing, that the above difference of loss and gain was made good by the continual supply of ammonia brought for France, principally by west winds. This was the commonly received theory until Hellriegel and Wilfarth showed conclusively that leguminous plants possess nodules infested by bacteria which fix atmospheric nitrogen, thus proving the accuracy of the ideas enounced by G Ville and by Berthelot, but disputed by most until 1888

The second cause of gain consists in the nitrogenous matters annually returned to the soil in the form of vegetable and animal refuse. But this is not a true gain, since these matters belonged originally to the soil to which they do but return. It is merely a restitution, and partial at that, since some is lost by becoming gaseous in the process, and much more is lost with the wood removed. The forest can only be supposed to become richer in nitrogen by assuming that the quantities obtained from the air and from rain are greater than those lost in the wood and by dissipation into the air, an assumption which no degree of optimism can warrant.

There is, however, a possible third cause of gain. If the soil or the plants could draw from the atmosphere direct some of its free nitrogen (which is four-fifths of the whole) without its having to be first combined with hydrogen or oxygen, there would no longer be just grounds to fear that one day the available supply of nitrogen will become insufficient for plant life, and consequently for the continuance of animal life on the earth. On the contrary an inexhaustible reservoir of nourishment would be available. It is well known that animals can fix directly in their bodies neither the atmospheric nitrogen, nor ammonia, nor nitric acid ; they obtain all their nitrogen from the proteid matters of plants Up to 1888 it was supposed that plants could indeed assimilate the two latter, but not the former. The principal advances since 1838 are as follows:—

1838—Boussingault's experiments began. He found a slight gain of nitrogen in clover and peas, none in wheat or oats. Without forming a decided conclusion, he is inclined to think that leguminous plants can fix nitrogen from the air.

1849-1852. M. George Ville made experiments, and stated that plants can assimilate gaseous nitrogen.

1851-1853. Boussingault made a second most careful set of experiments and concluded that gaseous nitrogen was not fixed by plants. not even by leguminous plants (lupins, haricot beans).

1861. Lawes, Gilbert, and Pugh, at Rothampstead, in order to test these contradictory statements, made experiments lasting 3 years. They took the most minute precautions, and their results confirmed those of Boussingault.

In 1879 it seemed that M. Grandeau was fully entitled to say "The matter is settled, plants do not absorb free nitrogen."

Nevertheless the prudent conclusions of the English chemists were less decided in the case of leguminous plants than in that of the gramineous class. In 1861 they wrote "after many trials 'with gramineous plants, and after varying the conditions of 'growth very widely, no assimilation of free nitrogen has been 'recognised. In the case of leguminous plants. the growth was 'less satisfactory, and the limits of variation were less, but the 'registered results show no assimilation of free nitrogen. *Fresh* '*experiments with these plants, in more favorable circumstances, are* '*desirable* "

To Hellriegel and his co-workers was reserved the honor of executing these desirable experiments, of carrying them out in a manner that left no room for doubt or controversy, and of clearing up at last an obscure and difficult question which had been ardently worked at and discussed by chemists and agriculturists since the days of Priestely, Ingenhoutz, and de Saussure, a hundred years ago The paper of Hellriegel, Wilfarth, and their collaborators dates from November 1888, though the principal conclusions had been announced in 1887 In the meantime there appeared some few researches on the fixation of nitrogen by the soil and by plants, of which the principal are the following

1873 M Dehérain published experiments showing that atmospheric nitrogen can combine with certain ternary substances, cellulose, glucose, &c, and as a corollary, with the decomposing matters in the soil But M Schloesing showed causes of error in these experiments, repeated them more carefully, and found no fixation of nitrogen

1875 M Berthelot asserted that certain non-nitrogenous organic substances, cellulose, benzine, turpentine, &c, with the aid of electricity, can fix the nitrogen of the air

1885 Ten years later, M Berthelot found a new and more general type of fixation of gaseous nitrogen, namely, the slow but incessant action of clay soils and of the microscopic organisims found in them

1886 In a second paper he discussed the nature and proportions of the organic matter contained in these soils, matter which is the fundamental basis of the whole edifice formed by these nitrogen-fixing micro-organisms

M Berthelot next studied the fixation of nitrogen, not merely in sandy clays and kaolins, but in the vegetable mould itself; and in a later memoir, its fixation in vegetable mould by the aid of plants "In fine" he says, "there was fixation of nitrogen in 'considerable quantities

'1 In sands and clays, as well as in mould, without vegetation;

'2. In the combination of plant and soil, when vegetation was introduced "

Thus, when Hellriegel's memoir appeared, it was already known through the work of Berthelot that soils with their contained micro-organisms can fix atmospheric nitrogen, but none of these micro-organisms were known, none had been isolated and seen, nothing was known of their mode of action, neither did their hypothetical presence in the soil explain the remarkable aptitude possessed by leguminous plants for prospering in a soil free from combined nitrogen, and for hoarding up in their tissues considerable quantities of a substance which could not be shown to exist in the soil.

For a long time botanists had been aware of the existence of nodules on leguminous roots Woronine in 1866, was the first to draw attention to innumerable corpuscles of their protoplasm, much resembling protococci and bacilli, and he considered them as microbes living in a symbiotic union with the plants, and manufacturing food for the benefit of the firm But nobody thought of any relation between the radical tubercles and the fixation of nitrogen The great credit of Hellriegel lies in the clear and decisive discovery of this relation His memoir marks an important date in agronomic science, and its principal conclusions are as follows —

"The assimilation and production of cereals, barley, and oats, 'were almost uniformly nil in a soil without nitrogen, whether 'sterilised or not

'By addition of nitrates, these plants underwent a normal 'development, more or less directly proportionate to the quantity 'of added nitrates (90 to 100 of dry soil to 1 of nitrogen)

'Nothing tended to show that these plants obtain, or might 'obtain, any appreciable quantity of nitrogen from other sources 'for their nutrition

'The leguminous plants tried, peas, serradelles, lupins, behaved 'exactly like the cereals in a sterilised medium that is to say, their 'growth and assimilation were practically nil

'This is the same result as Boussingault obtained in 1853

'Nitrates produced the same effect on them as on cereals whenever nitrogen was present in very small proportions

'In a soil without nitrogen, leguminous growth was sure to be 'obtained by adding a slight mixture of fertile soil Not only was 'normal vegetation obtained, but often even a luxuriant develop'ment, and in this case, the crop often showed a great excess of 'nitrogen which could not possibly have come from the soil "

The necessary conclusion was, that the small portion of fertile soil added had contained the germs of bacteria which attached themselves to the roots, produced nodules there, and set up a process of transferring gaseous nitrogen from the air into a combination with the substances of the plant. These facts have now been thoroughly verified, and as M Dehérain says, " agricultural 'practice has taken advantage of them , it has, by means of a 'dressing of fertile earth, succeeded in making leguminous crops 'grow on soils that had hitherto been refractory " Quite recently, M Mazé has shown that leguminous plants have to furnish to the nodular microbes the organic nitrogen necessary to start the early generations Once well established, the microbe begins to manufacture and may fix from the air as much as two-thirds of the total amount of nitrogen contained in the soil

Forest soils especially the sandiest and poorest, abound in leguminaceae, and it is especially in this case, when the soil provides insufficient combined nitrogen, that the plants help themselves to the necessary quantity by taking it from the air In many forests on sandy soils, brooms, furze, &c, with Cytisus, Ononis, &c form a large part of the undergrowth, while on limestone soils, some of the same or other leguminaceae, Calycotoma, Cytisus, Coronilla, brooms, Ononis, Adenocarpus, &c, serve the same purpose Thus Hellriegel's discovery is of interest to foresters, by pointing to one of the causes which compensate the loss of nitrogen from forest soils

I think there is however, a more important and general compensating cause, hitherto ignored, namely, the fixation of nitrogen from the air by dead leaves In November 1894, in the Forêt de Haye, I gathered off the young oaks and hornbeams, the dead leaves which had not yet fallen to the ground I dried them first at the temperature of the laboratory, then at 100 °C The oak leaves contained 9 75 per cent of moisture, and the hornbeam 12 70 per cent The nitrogen in the oak leaves was 1 108 per cent and in the hornbeam leaves 0 947 per cent Of oak leaves dried at 100 ° C, some 48 96 grammes (equal to 53 130 grammes air-dried) were put into a zinc box 50 c m square having at the bottom a slab of limestone and at the top a galvanised iron wire netting Another lot of the same leaves weighing 53 54 grammes dry at 100 C, were put into a similar box with a slab of sandstone ("gres bigarre," or "bunter sandstein") Two other lots of hornbeam leaves, each weighing 43 65 grammes dried at 100 ° C, were put into two other similar boxes

These boxes were exposed in the open air, on a support 60 c m high, protected from any possible emanations from the soil and from any possible source of ammonia The object of this experiment was a double one, (1) to study the relative rapidity of decomposition of the leaves, according as they lay on limestone or sandstone, (2) to follow the qualitative and quantitative changes occurring in both the mineral and organic substances, until their complete conversion to humus Most interesting to me, among the organic matters were the nitrogenous products

Given that humification, or the decomposition of dead leaves in presence of air, is essentially due to micro-organisms, as I showed in 1886, and on the other hand, that this decomposition, being active, demands the presence of myriads of microbes, one is led to study their action Being themselves chemically nothing but little masses of protoplasm, i e nitrogenous matter, they would probably make good the loss in the leaves by dissipation of gaseous nitrogen But if among these many microbes, there should be any kinds possessing the same precious faculty as that of the nodule microbe, it might be expected that they also would similarly enrich their hosts, the leaves My experiments showed the latter supposition to be really the case In December 1895, after being exposed to the air for a year, the oak leaves lying on limestone contained 1 923 per cent, of nitrogen, and the hornbeam leaves on ndstone contained 2 246 per cent. dried at 100 °C as before.

The gain was thus 0·815 grammes of nitrogen per 100 grammes oak leaves and 1·299 grammes of nitrogen per 100 grammes of hornbeam leaves. The original percentages having been 1·108 for oak, and 0·947 for hornbeam, it is seen that the amount of nitrogen was about doubled.

During this year, the oak leaves lost 21·62 % of their original weight at 100° C and the hornbeam leaves 23·01 %. Making the most unfavorable supposition and granting, what is very unlikely, *viz.* that this loss all came from the ternary compounds, and that no soluble ammoniacal compounds, nitrates, or amides, were formed at the expense of the original nitrogen of the leaves, and carried off by surface waters, the percentage 1·923 being referred no longer to the weight of the leaves in December 1895, but to their weight at the beginning of the experiments becomes 1·508. Similarly the percentage 2·246 becomes 1·727. The absolute gain of nitrogen then was really 1·508—1·100 = 0·400 % of the original weight for oak, and 1·727—0·947 = 0·780 % for hornbeam.

This gain of nitrogen is very important, since even in the latter case, it reaches half or two thirds of the original percentage. Assuming that each autumn the soil receives 3 300 kilos of dead leaves, this represents a total of 22·4 kilos of nitrogen from hornbeam leaves, and 13·2 kilos of nitrogen from oak leaves or about the quantity absorbed in the formation of wood. This greatest cause of nitrogen loss in forest soils is thus at once compensated by the activity of the dead leaves in appropriating atmospheric nitrogen. This capital fact now explains the most general, if not the principal, reason for the well-known and long admitted beliefs that forests not only improve the soil but constitute the only culture which is capable of inducing very poor soils to bear periodic field crops. The leaf covering of the soil, already so highly valued by foresters for its physical and chemical services thus, by its faculty of appropriating nitrogen from the air, acquires a new claim to our appreciation, now, I believe, brought to notice for the first time.

As already stated, M. Berthelot, in his experiments of 1885, showed the fixation of nitrogen in sands, clays, and mould. In 1868, MM. Gautier and Drouin stated "that humus, and even 'humic acid made chemically from sugar and acids, are able to 'fertilise soils, either natural or artificially compounded of silica, 'lime and kaolin, whether with or without vegetation, by enabling 'them to become richer in nitrogen, that the only soils capable of 'fixing the atmospheric nitrogen or ammonia were bare soils containing organic matter, and that humus compounds are a necessary 'condition of this fixation." My experiments, however, refer neither to humus nor to soil, but to dead leaves still hanging on the branches, and which, though exposed to the air for two years, were in no sense reduced to humus, that is to say, a black and matted substance having lost all trace of vegetable organisation.

The oak and hornbeam leaves were indeed black, but perfectly recognisable The discovery of M. M Berthelot, Gautier, and Drouin, that humus, with or without soil can fix gaseous nitrogen is too limited, and does not cover the whole fact, for the leaf as soon as it is dead, and as long as it preserves its shape, possesses that precious faculty

Leaves are indeed most admirable organs All their lives they work hard at the formation of plastic materials necessary for the present and future life of the tree They die when the external atmospheric conditions no longer permit them to work But before dying they store up in the tree in a place of safety, those rare and valuable substances, nitrogen, potass phosphorus, which in the spring will call into being a new suit of leaves, just as hard-working as their forbears In falling, they carry with them the smallest possible quantity of these substances, the *caput mortuum* which was incapable of removing itself into the twigs and branches But even in death they hasten to begin a new work for the tree which produced them. So soon as fine weather comes round they provide food for myriads of micro-organisms, which show their presence and activity by a free evolution of carbonic acid, and which include a certain number which are able to absorb not only oxygen, but nitrogen itself, and utilise it in the constitution of their protoplasm

The two other boxes, containing oak leaves on sandstone, and hornbeam leaves on limestone, were left for 2 years, from December 1894 to December 1896, exposed to the air Moreover, in May 1896 I added to each box 50 grammes of fine soil from the Forêt de Haye, after previously ascertaining the quantities of water and organic matter contained The nitrogen analysis showed results perfectly concordant with the previous ones , 1 73 % in the oak leaves dried at 100° C on sandstone, and 2 15 % for hornbeam on limestone, or a little less (from 0 1 to 0 2 %) than the previous years figures, that year having been one in which the microbes were rather active But these figures are still much greater than the original percentages, showing a relative gain of 0 6 %. for oak, and 1 0 % for hornbeam During these 2 years, the oak leaves lost 29 64 % of their weight, and the hornbeam leaves lost 28·6 % of their weight

Again, granting, to render the appropriation of nitrogen more conclusive, that the 28 % to 29 % lost included no nitrogenous matters, there was nevertheless an absolute gain of 1 22—1 11 = 0·11 % of the initial weight for oak, and of 1·53—0·95 = 0 58 % for hornbeam

Tracing a curve to represent the percentage of nitrogen in a leaf, from its birth to its transformation into humus, it is seen that the fall of the leaf corresponds to a fall, followed by a rise again, due to the appropriation of nitrogen These are the figures for oak leaves ,—

May ...	25·0 per cent. of nitrogenous matters.	(Ebermayer.)
June ...	14·6	
July ...	14·0	
August ...	9·9	
September ...	7·0	
October ...	6·6	
December 1894 ..	6·9	
" 1895 ...	12·0	
" 1896 ...	10·8	

Thus, if in nature things proceed as they did in my experiments, the 8·300 kilos of dead leaves, annually falling on to the hectare, contain at the moment of fall 1 per cent. of nitrogen, or 83 kilos of nitrogen altogether, in 206 kilos of nitrogenous substances.

After 2 years, the leaves of oak and hornbeam, which had been exposed, as in the forest, to all the atmospheric influences, lying on a slab of limestone or sandstone, so as to retain moisture as much as possible, were quite black, but perfectly recognisable, both oak and hornbeam, notwithstanding the supposed inferior durability of the latter. They were far from attaining the state of humus.

For the complete exhaustion of the subject, and the removal of all possible doubts, it would be neccessary to isolate the micro-organisms which feed on the leaves and fix the nitrogen, to breed them in pure cultivations, and demonstrate directly their absorptive faculty by the diminution of the definite volumes of nitrogen in which they would be kept, as was done by M. M. Schloesing junr. and Laurent for the leguminous bacteria, but these points are beyond my competence, and can only be elucidated by bacteriologists. I have sent these nitrogen-fixing leaves to M. Macé, who has kindly undertaken to study them.

Among those soil micro-organisms whose nitrogen-fixing function has been clearly determined, there is, beside the leguminous bacteria, perhaps only one, the Clostridium pasteurianum, recently discovered by Vinogradsky, which need be mentioned. I can do no better than here give the opinion of an acknowledged master in bacteriology on this subject

"Vinogradsky starts from the fact that the assimilation of nitrogen is a widespread phenomenon in the soil of fields and pastures, that there is difficulty in accounting for it by the action of a few plants or algæ, and thinks that this assimilation must be brought about by microbes, especially by those which are satisfied with a medium rich in carbon but poor in nitrogen. He has sought for and found them by the method of selective cultivations. Here are his conclusions.

"Out of 10 microbes obtained from soil, not one, not even Aspergillus, could assimilate free nitrogen.

"Not one of the microbes could develop in a medium totally 'free from nitrogen and the Clostridium pasteurianum is in this 'respect unique It alone can fix enough nitrogen for its needs 'from the beginning to the end of its growth

"The author allows, contrary to the opinion of M Berthelot 'that the faculty of fixing nitrogen is not very common in microbe 'society and is a special attribute of one or few species, of which 'one alone the Clostridium pasteurianum, is at present known"

In the conclusion drawn from a recent study of the same subject, M Claude Fermi says —

' Among the micro-organisms studied by me I found none 'cultivable in solutions of pure saccharose which were capable 'of fixing nitrogen from the air In this respect my conclusions confirm those of Vinogradsky "

As for the supposed fixation of nitrogen by certain of the inferior algæ this action ought to be recognisable in forests where those algæ are found, but it appears not to be due to the algæ themselves, as M M Schloesing junr, and Laurent thought, but to the colonies of bacteria which live on them

"In pure cultivations" says M Kossowitch "free from bacteria, the algæ do not fix nitrogen But when exposed to 'light and aided by the bacteria, they can produce the effect 'directly by furnishing the micro-organisms with the hydrocarbons necessary to their development Being better nourished, 'the bacteria develop freely, and consequently fix a rapidly increasing amount of nitrogen"

M Bouilhac has also noticed that the fixation of nitrogen can occur through the association of certain algæ and bacteria

Certain authors, like M Stoklasa of Prague referring to the assimilation of nitrogen by lupins, even attribute a more effective action to the algæ and bacteria of the soil than to the nodule bacteria

Though the fact of the assimilation of nitrogen by plants is now beyond dispute, its mechanism is still very obscure It is but seen darkly, as yet very few are known of those organisms whose function is to compensate the losses of combined nitrogen which are incessantly going on throughout the world Ten years ago, the only compensatory cause that could be mentioned was the combination of atmospheric nitrogen with the hydrogen of water under the influence of electricity

Bacteriologists will now find a profitable field for investigation in the dead leaves of the forest, at the time when they are the seat of active decomposition brought about by ærobic micro-organisms, (the class whose technique is at present best understood,) and they will probably soon be able to add a few names to the short list of known nitrogen-fixing microbes

As the result of my experiments, which are still being continued with varying material and under various conditions, I think I have demonstrated one of the causes, perhaps the most important, cer-

certainly the most general which produce the effect of continuous improvement in forest soils. Owing to the chemical reactions being more prolonged and active in forest then elsewhere, mineral nutritive substances become more plentiful in forest soils. This has long been recognised. But since the acquisition of definite knowledge as to the smallness of the quantities of combined nitrogen supplied by the air, and by rain, &c., it has been difficult to account for the real and ample supply of nitrogen. Thus the forest, the great benefactress, is not content with giving us wood and all its derivatives, a crowd of minor products, the protection of mountains from erosion, the freshness of its shade, and the charm of its greenery, it is also the greatest and the cheapest means available for enriching the soil with two groups of substances as rare as they are necessary, namely nitrogenous matters and mineral nutriment, enabling, with time, but without cost, the poorest soils to supply the needs of agricultural crops.

Obituary—Mr. C. H. Hobart Hampden.

We much regret to hear of the death in October last while at home on furlough, of Mr. C. H. Hobart-Hampden, Deputy Conservator of Forests, Burma. Mr. Hobart-Hampden, was only 34 years old, and had put in the whole of his 12 years service in Burma.

II.—CORRESPONDENCE

Extra Pensions for the Forest Department.

Referring to an extract taken out of the "Englishman" on the above subject, or, as it is there termed "The Grievances of the Forest Department," in the issue of the Indian Forester for January last, the Department can well afford to shelve the "equality" question and base its claim to the extra pension on the distinct assertions of the Secretary of State himself both in Parliament and in his own Despatches, to wit:—

(1) No. 188 Financial, dated the 21st September, 1893, paras 13 and 11.

(2) No. 230 Financial, dated the 26th December, 1895 (declining to re-open the question and re-iterating the fact that the Head of the Department in any Province will be entitled to the extra pension) let alone the statements made in the Coopers Hill Prospectus of 1894 and following years.

Our claim now is that the orders conveyed in Despatch No 109 dated the 9th July, 1896, entirely ignore the principles under which these extra pensions are now granted to all Departments of the old Uncovenanted Service and run counter to the distinct assertions given in the above Despatches, one of which (No 230 dated 26th December, 1895) was actually forwarded by the Government of India to Local Governments for information and for communication to all Forest Officers appointed from England, in Revenue and Agricultural Department (Forests) Circular Res No $\frac{4}{55\ 2\ F}$ dated the 16th March, 1896 presumably in reply to the many memorials they had received on the subject

All we need now ask is that the Secretary of State will fulfil his promises given after much deliberation and careful consideration and surely we have a right to expect this

So far the Forest Department has been treated as no other Department of the old Unconvenanted Service and it is questionable whether the result does not absolutely deter men from retiring rather than confer a boon on the Department at large

"1894"

Dry Rot in Deodar trees.

I am sending you a section of a deodar log for your inspection You will observe the ring of dry rot in the centre and I shall be glad if you can suggest the cause This is a very common form of decay found in the tree in the Kashmir valley I have marked trees myself for felling, which to outward view looked perfectly sound, yet on being felled were found to be useless for timber from being decayed in the manner seen in the specimen sent I do not remember to have seen such a thing in the deodar trees of the Ravi valley or in Pangi, nor yet in any other valley of this State, except the forests above Baramula in the Kashmir valley proper

KASHMIR, }
25th October }

J. C. McD.

Sir Richard Strachey and Indian Forestry.

With reference to Sir Dietrich Brandis' article on "Sir Richard Strachey and Indian Forestry" in the September No of the Indian Forester perhaps it would interest both Sir Dietrich and Sir Richard to learn that the Forest Department of Bengal prepared no less them 2,16,000 broad guage sleepers of Sal in the Singhbhum Forest for the Rai-Bareilly—Benares Railway between the 1st February, 1896, and the 1st October, 1897.

A. E WILD,
CONSERVATOR FORESTS,
Bengal

Dated 20th November, 1897

The after-Training of Cooper's Hill Men.

Could you prevail upon Mr. "Scrutator," whose letter on the after-training of Coopers Hill men appeared in the October number of the Indian Forester, to reveal his identity to an admiring world? It would be interesting to know where and how he has contracted such a sovereign contempt for theoretical knowledge in general and the Coopers Hill man's in particular Can he be one of those gifted individuals who has been able to become, in his own estimation at any rate, the "Ideal Forest Officer" without preliminary training of any sort? If so, a little moderation in referring to others less gifted than himself is the humble suggestion of

"SPIFLICATOR."

III.—OFFICIAL PAPERS & INTELLIGENCE

Report G A. C. Bourne, Esq. D.Sc., F R S, Superintendent Government Museum, Madras, on the destruction of prickly-pear with the aid of the cochineal insect or other parasite.

Experiments—As soon as I had undertaken to investigate this matter I selected a clump of the ordinary yellow-flowered prickly-pear (*Opuntia dillenii*) growing in the Museum grounds and also procured from the Agri-Horticultural Society's gardens plants of the red-flowered species (*O. cochinellifera*) and of three other species (*O decumana, O. monacantha* and *O.spinosissima*).

I then examined the insects sent to the Superintendent of the Government Museum with the Proceedings of the Board of Revenue, Mis. No 3,844, dated 4th August, 1896, and satisfied myself that these were cochineal insects of the so-called "wild" variety (*Coccus cacti*, var. *Grana sylvestris*). I procured a fresh supply of these from Ganjám and thanks to my instructions with regard to the packing having been most carefully carried out and to the fact that it *happened* to be the most suitable time for the transfer they reached me alive and I was able to experiment with them The time for the transfer was the most suitable, because the young insects were just ready to be hatched, and it is only just after hatching that they will migrate from one leaf to another and so from one plant to another they very soon fix themselves and the females at any rate never move again I *might* have had supplies month after month without securing this exact stage

By carefully attaching portions of the leaves bearing pregnant mothers to my own plants, I got the young to migrate and many fixed themselves on all my species of cactus

The specimens sent were all attached to the red flowered cactus, although some leaves of the yellow flowered species were also packed in the basket

The insects which attached themselves to my clump of yellow flowered cactus exposed to the sun died within a week and the rain removed all traces of them Those on the same species which I had growing in a pot and shaded from the full sun, lived considerably longer but the only ones which lived for any length of time—4 months—were those on the red flowered species (*O cochinellifera*) They all ultimately died and disappeared and although I still watch the plants there is no trace of their reappearance nor does our knowledge of the life history lead me to expect that there ever will be I failed therefore to rear the cochineal insects in Madras, but had this been my object knowing that it has been done before, I should have tried again taking even greater precautions to protect the young insects The present object is, however, to destroy the prickly-pear and it is obvious that if tried on a large scale the experiment could not be accompanied by any special precautions for the protection of the insects

2 *Historical résumé*—The historical evidence weighs entirely against the practicability of destroying prickly-pear by the cochineal insect The literature of the subject is very voluminous and I propose to give here a very brief résumé only

There seems to be no doubt but that the cochineal insects and the cactuses are all introductions and the net result has been that the yellow-flowered cactus has thoroughly naturalised itself, while the cochineal insect has just managed to struggle on here and there

There is evidence that cochineal insects were introduced five times between 1795 and 1883 with a view to the establishment of the cochineal industry in the country In 1807 Government offered a reward of £2,000 for its successful introduction It never became thoroughly established It was, however, possible that, although a fine variety of the insect best for industrial purposes would not flourish a wilder variety might become more or less naturalised, this has occurred to a small extent and the idea of utilising this to destroy prickly-pear has been from time to time put forward

From 1862 to 1868 repeated experiments appear to have been made on a large scale at Raichur, Atur, Palmanér, Madras, Bellary, Secunderabad, Pallávaram and other places in some cases with a certain measure of success. This partial success is in itself I consider, a strong argument against the utility of repeating the experiments. They obviously ultimately failed—as the prickly-pear has not been eradicated in those localities—and were evidently after a time abandoned. It is, on the other hand, clear that during the experiments, the insects were widely distributed and the reports of success in some places show that it took a thorough hold only to die out in time, while the prickly-pear must soon have sprung up again

3. *Remarks on other parasites.*—I have only up to now been able to find one other parasite attacking prickly-pear ; that is a mycelial growth which is reported to have caused *great damage* to a prickly-pear hedge at a salt factory in the Nellore district. I secured specimens and found the disease to be a mycelial growth which, by gradually indurating the epidermis and blocking the stomata, caused the whole substance of the leaf to rot. I preserved the specimens and watched their gradual decay, and some time after this was complete and the leaves had dried up, they began to sprout and put forth healthy young leaves. This is an instance of the extraordinary vitality of the plant I endeavoured, but unsuccessfully, to infect a clump of prickly-pear in the Museum compound with this disease which leads me to think that unfavourable conditions in the soil or climate must have favoured its spread on the spot

4. *Conclusion*—I shall continue to observe and experiment in regard to this matter as opportunity offers. I am hoping to visit Ganjam on a botanical tour in December-January and shall then examine the *Coccus* on the spot where alone it appears to have persisted in any quantity, but my present opinion is that it is impracticable to destroy prickly-pear in the manner suggested. The *Coccus* belongs to an extremely obnoxious group of insects—the plant bugs—and supposing a *wild* variety were to spread all over the country and to have eaten up all the prickly-pear, I think it is possible—I cannot say probable—that it or some species, which might have spread with it, would turn to some other plant for food and become an infinitely greater pest then the prickly-pear. This argument applies with great force to a mycelial growth or other parasite which might prove less selective with regard to its food than the cochineal insect has.

Ceara Rubber.

The Madras Government has recently issued a resolution on the experimental cultivation of Ceara rubber in the Malabar district. The experiments have not been very encouraging but the Government is of opinion that the matter should be kept in mind and that it should be considered whether the cultivation cannot be improved. The following are the reports which form the subject of the Resolution.

Report by M. R Ry V S Guruuatha Pillai, Acting District Forest Officer, South Malabar, dated Nilambur 6th February, 1897

'In January 1895 one hundred Ceara rubber trees were tapped in Iravallikavu both morning and evening, each tree was tapped six times, *i e*, twice a day for three days and 10 lb of rubber was collected which was valued at 1 shilling 6 pence to 1*s* 9*d* per lb in England'

'In the latter end of December 1896, 309 trees were tapped and 24 lb. of rubber collected; the largest tree tapped, *i e*, 3 feet 9 inches in girth gave 8 oz of solid rubber and the smallest, *i.e*, 3½ inches in girth gave ⅛ of an oz, on an average 1 oz per tree was collected'

'*Method of Tapping*—A few trees were tapped by making incisions on the trunk of various shapes and little cups made from leaves were pinned underneath to receive the milk, but it was found that no milk could be collected in this way The milk trickling down the stem from the incisions was after three days peeled off in long strips which gave a few grains of rubber per tree, but the rubber was of good quality, *i e*, clean and very elastic and free from disagreeable odour'

'The other trees were tapped as follows, the large roots near the surface were laid bare, and incisions 1½ to 1 inch long and ½ an inch apart were made on the exposed roots with a bill-hook and the milk collected in little pits dug in the ground under the roots to receive the milk The trees were tapped twice a day for three days, *i e*, between 6 to 10 A M in the morning and between 4 and 6 P M in the evening and on the next morning the milk was found to be coagulated in hard tongues These were removed and the tree tapped again as before

'It was noticed that the trees bled more freely in the early morning than late in the day, *i e*, a tree tapped at 6 A M would bleed for 10 to 15 minutes, while those tapped later would only bleed for 5 or 6 minutes as the heat caused the milk to set much quicker and clog the milk ducts Again trees growing on moist alluvial soil bled more freely than those growing on dry soil; a small sized tree with a girth of 21 inches standing on good moist soil and little distant from the surrounding teak gave 4½ oz of rubber, while a tree growing on dry soil and surrounded by teak though 37 inches in girth gave only ¾ oz of rubber Particular notice was taken of the trees tapped in January 1895, the incisions made then were completely healed and those that bled well then bled freely even this year From this it is plain that soil and surroundings have a good deal to do with rubber-producing qualities of the Ceara'

'In March and April 1896 attempts were made to tap but with little success, the trees bled but little; the weather being too dry and hot and the trees leafless; the best season to tap is between December and February.'

'From the experiment tried it has been noticed that trees planted 20 yards apart, i. e, 100 trees per acre (the soil being favorable, i e., deep moist alluvial soil) will produce on an average 4 oz of solid rubber per tree per annum when 3 feet in girth in about 18 years'

Report by Mr. H. Tireman, District Forest Officer, North Malabar, dated Manantoddy, 29th August, 1897.

'Twenty-three Ceara rubber trees were tapped at the end of May this year The average girth of these trees was 21 inches. The yield was 8 oz. of rubber. These trees were tapped three times on three consecutive days. They had never been tapped before In July during a break in the rains, 67 trees, all of which had been tapped last September, were again tapped once. Their average girth was 27 inches and the yield was 20 oz. I will do some further tapping after the rains are over I do not, however, think that the Ceara rubber is of any use as a rubber producer, compared with Ficus elastica and Hevea Brazillensis.'

VI -EXTRACTS, NOTES AND QUERIES.

The Significance of Afforestation in Preventing and Correcting Torrents.

BY DR F FANKHAUSER.

Address delivered before the Bern Forestry Association, June 18th, 1897.

In every forest there are three more or less distinctly marked divisions—the collecting area, the channel course, and the heap of débris. It is in the collecting area that the principal mass of water is gathered which goes to form a torrent. Single drops falling on the topmost ridges flow together down their bare sides in fine thread-like streams and there unite again into larger and larger brooks. While mere drops wash away only earth and sand (thus indeed loosening the hold of larger rocky masses) the brooks overcome stones and coarser material.

Thus even in the collecting area erosion begins The mass of waters descending on all sides is received in the valley bottom by the channel course In times of freshets the raging torrent rushes down its narrow bed The angry flood, weighted with earth, sand and stones tears away and undermines fresh material from the bed and sides of the torrent Robbed of their foundation the projecting banks give way and add to the moving débris

Large slides sometimes block and obstruct the streams until the whole mass, softened by the water, gives away to the pressure and moves on as a so-called ' *Muhrgang* " with destructive force, bearing everything before it

When the torrent emerges from a narrow bed into the level plain or a larger valley, its force diminishes The rubbish is then heaped up now on one side now on the other into a heap or cone of debris or it may be washed away by a larger stream or river

The most striking phenomenon in every torrent is its changing amount of water The Rhine at Basle, for example, varies between its lowest and highest level as one is to twenty While the Tessin increases from one to one hundred and fifty, and many a torrent with restricted collecting area increases a thousand fold This is due to the fact that in a bare collecting area scarcely any water is soaked up by the soil The largest part flows down steep slopes and meets from all sides almost simultaneously in the valley bottom Demontzey (French general forest inspector) relates that in a certain outburst of the torrent of Faucon in the Lower Alps seventy per cent of the rainfall, or about 65,000 cubic meters of water had flowed off in twenty minutes, carrying away three times this amount in volume of earth and gravel

The danger of torrents depends on different circumstances Firstly, as a matter of course, the amount of rain is decisive. Long, persistent rains are more perceptible in the rising of large rivers In mountain torrents the shorter thunder storms and cloud bursts which last from half an hour and supply an enormous mass of water have more effect

Storms accompanied by hail are most especially to be feared, tearing up the naked soil, causing mud and stones to be washed away with great ease and force

The same amount of rainfall will thus have a different effect according to the nature of the soil and lay of the land The wider the collecting area and the higher up its slopes extend, the greater will be the mass of descending waters, and the steeper the descent the greater will be their velocity and undermining force

The less power of resistance in the soil the more it is swept away by the water On this account, we have in Switzerland the most terrible torrents in loose glacial debris

From what has been said it can be inferred what means are to be used in conquering a torrent On the one hand we can try to make the stream bed more solid and capable of resistance, and break the force of the water as much as possible On the other hand the flow of water in the collecting area can be retarded by a sufficient cover of vegetation which will prevent the starting of floods The first is accomplished by protective works, the other by afforestation

The most important aid of a technical description is the "*Thalsperre*" By means of solid transverse dams, behind which the débris is blocked, the stream is prevented from digging a deeper bed

At the same time the rate of flow is diminished by these falls, and by leading it into mid-channel the bank is protected from erosion Various sorts of bank protection serve this purpose Every impartial observer must admit that in the matter of works for the correction of torrents, we in Switzerland as well as elsewhere, have accomplished wonders, and the results are most conspicuous

Many dangerous torrents have been tamed by engineering efforts, to which a large number of places owe the security of life and property against the devastating force of the elements

But the conquest of a torrent by means of engineering constructions alone has also its dark side Where a simultaneous improvement of conditions regulating the water sources is neglected, constructions in order to withstand for all time the dashing of powerful floods must not only be built very solidly but must be maintained continuously in their original condition

This point assumes great importance even where stone suitable for the works is easily accessible, because it is a question of using a passive and perishable means to oppose living forces, which are inexhaustible and constantly operating

The conditions are especially unfavorable where a durable material is lacking, and wood has to be used for these constructions Unless constantly under water wood has a minimum durability Wooden works, as many instances prove are unfortunately effective only 10 or 12 years It could easily be computed from works already built and those contemplated what an enormous quantity of wood is required for building and repairs A large part of the yield of our forests would be necessary to supply material, let alone the exorbitant sums required for construction and maintenance

This is an evil inseparable from the method of rendering torrents harmless to the mountain regions by means of such constructions alone But the bad results of this system are equally apparent in the thickly populated fruitful low regions, causing here even greater and more disastrous harm

On account of the great cost of building and maintaining these works it is generally necessary to confine them to the channel course, and to stop here the main sources of erosion But as we have seen, erosion begins not here but in the uppermost collecting area

The gathering of débris is not prevented by the construction, only lessened. Every little side rivulet delivers its quota, and in the course of decades all these washings count up to a considerable quantity As long as the newly built "Thalsperren" (dams) are not filled up, sand and stone are held fast behind them, and the results are satisfactory But when the leveling process is complete, the brook then pours at flood times its material over the dam as easily or more so than before it was built. From the brooks the sediment gets into the rivers, and these again when they are treated in like manner carry it off into the low lands As sediment cannot be dissolved by water it remains where the fall is too slight to carry it further, and causes a raising of the level of the river bed Thus in 10 years the Rhine bed at Buchs in Canton St Gallen had risen about a metre The high water dams must naturally be raised in proportion, and this can go so far that at last the river bed becomes higher than the surrounding country

It is easy to calculate what eminent danger ensues to neighbouring lands from these conditions, in spite of successive costly raising of the barriers

But this is not all As the river rises the level of the underground water also rises until at last the valuable adjacent fields are converted into marsh land, and expensive drainage canals are made necessary One work leads to another and yet affords no permanent relief, because instead of holding the débris back among the hills it is only carried further on, and thus at great expense the trouble is shifted from one place to another, not overcome

You see gentlemen, that all technical constructions of this sort only aim at providing a barrier As the French engineer Surell in his famous study of torrents has so aptly said, they are measures of defence, but they do not lessen the power of the waters, they only compel them for a moment to keep certain bounds Entirely different is the effect of the forest Of course it is not a question, as many mistakenly suppose, of foresting the overhanging banks and sides of a torrent to prevent undermining and land slides A wood is as powerless as the soil itself to resist a torrent, and succumbs with the soil to the rush of waters. But in the uppermost collecting area a forest growth holds the accumulations from heavy rain falls and hail storms, and thus prevents the great and sudden swelling of streams

Only reflect that the leaves of a medium aged beech forest if spread out would cover 8 times the area that the growth in question occupies, and it will be quite apparent that even in the hardest downpours almost one-fifth of the water is intercepted by the foliage, and thence flows slowly down the trunks or passes off in vapour.

Still greater is the quantity of water which is taken up by the soil cover, and held fast as though by a sponge

The small flow from out of a dense forest cover even in heavy rain falls, is so long delayed that a large part trickles into the ground, which in the forest is in a soft and porous state, and also intersected by a network of canals, caused by the decay of roots where trees have been felled, which serve to carry the water rapidly down to lower strata. Quite different is the state of affairs in open country. Here on bare slopes the largest part of a rainfall is obliged to run off over the surface.

If, therefore, we are able partly to stop entirely the flow of water, partly to delay it, we can prevent extraordinary freshets, and as it is only these which cause devastation, and a torrent under ordinary conditions is not productive of any considerable harm, this sort of regulation of the discharge puts an end to the possibility of devastation. We transform a torrent into a woodland brook, which instead of being a curse to the region, thanks to its even and constant water supply, may become a blessing to agriculture and industry.

It will be seen that the torrent to be conquered is attacked by the forester at its source where its forces are as yet scattered, and thus easily tamed. Here by means of forestation we are able on the one hand to retard the water, on the other hand to secure the soil. In this way only is a lasting remedy of the evil possible. If you dispense with this means of help, which nature herself applies when not intercepted by man, the constructive treatment of brooks in every difficult case is only a palliation, and sooner or later retribution follows, unless at the same time the most important cause of freshets is recognized, and the steep slopes of collecting basins, which have been cleared of wood by ruthless stripping, are re-clothed.

I could demonstrate the correctness of this view by countless examples of new forest plantings in Southern France, which, partly with accompanying enginering constructions, partly without them, have been the means of subduing and rendering harmless for all time the most dangerous and devastating torrents.

One of these instances only need here be mentioned.

The *Labouret* is a little valley of 113 hectares in surface extent in the department of Lower Alps, in the collecting basin of one of the tributaries of the Durance.

Up through this valley and at its upper end over the pass of *Labouret* the long and important highway leads from Montpelier to Coni. Previous to 1860 the region in question was entirely barren, so that even the sheep found nothing more to nibble. In every storm the water rushed down the steep naked banks with great velocity ; it dug countless deep gullies in the soil (composed of Lias-Marl), and in the gorge became a resistless torrent which undermined both banks, causing landslides which tore away the roadbed, now here, now there so that traffic was continually interrupted. Conditions were indeed so serious that the *Labouret* became notorious far and wide as a place of terror Such reputation may indeed have been well founded, as the engineers knew no other way out of the difficulty than to propose a new route, the cost of which was estimated at 400,000 francs

This was the situation in the summer of 1862 when the first attempt of the sort in the French Alps was made, viz the artificial 'regazonnement and reboisement of the *Labouret* (in other words the fixing of the soil by stocking with grass and trees) In 1874 the principal protective and cultural works were finished, and notwithstanding that no large constructions had been built, all danger for the road was over To-day, except a few steep hill sides not yet sufficiently afforested, you would find the whole area clothed with luxuriant thrifty woods, and the once dreaded torrent of *Labouret* flows over the low dams in the valley bed a harmless streamlet in the shadow of dense thickets of alders, poplars, ashes, and maples

Even the severest storms which have since burst upon the region have only caused a moderate rising and muddiness of the waters and every danger of washing away has entirely disappeared

This is only an example on a small scale, but it is applicable for extended water sheds as great freshets are only made up of a series of small torrents each one of which can be treated in a similar manner

In the Western Cevennes for example, in the department of Herault there are two rivers, the *Orbe* and the *Jaur* During a freshet on the 12th of September 1875, within a few hours 150 dwellings were destroyed and 100 lives lost causing a total damage valued officially, at over three million francs

In September 1890, there occurred in the same department still more fearful rainfalls and floods The vineyards alone in the plain on the lower course of the Herault suffered a loss of 15 million francs not to mention other extensive devastations In the collecting areas of the *Orbe* and the *Jaur* where meantime extended new forest plantings had been carried out, no appreciable erosion took place Washing away of débris was this time insignificant, and the water remained comparatively clear

You see, gentlemen, from these instances how far the beneficial effects of well-wooded mountain regions extend, and what extraordinary interest we have in Switzerland on behalf of the low country between the Alps and Jura, that the forests in the mountains should be properly managed, and where necessary newly laid out on a large scale Mistakes and failures here will be fatal, not only for the immediate surroundings, but for the whole country The benefits of our Federal law relating to the forest administration in high regions are by no means confined to these regions only, but in a still greater degree are felt by the thickly settled low lands, and there is absolutely no foundation for the assumption that the mountain regions were favored at the expense of the low regions. Quite the contrary is the case. The law imposes considerable hardships and sacrifices upon the mountain populations, it restricts the right of control over their own forests by limiting the minor products such as wood pasture and gathering of litter, and it enforces many other regulations which for the most part decidedly benefit the low country, and not the mountain inhabitants.

The Federal contributions for afforestation are therefore only an equitable and by no means an adequate indemnification for the sacrifices made in behalf of the whole country.

Perhaps it would be of interest to learn exactly what areas should be afforested. Although nothing can be formulated in a few words which would be invariably applicable it may be stated that the forestation of a fertile and productive area becomes necessary in proportion to its steepness.

The greater the number of steep bare slopes in the collecting area of a torrent, the more dangerous is it and the more extended should be the afforestation. That the formation and composition of the soil is a point to consider goes without saying but the valuation of the land in question must also be included in the calculations. Where it is worth two or three thousand francs per hectare, it may be better economy to extend the engineering works, and to decrease afforestation correspondingly.

You see therefore gentlemen that what the forestry folk recommend is not a reckless transformation of valuable agricultural land into forest. Only the least desirable areas in the uppermost regions are demanded. This last point is indeed of consequence. Afforestation must reach to as high an altitude as climatic conditions will possibly admit of, if possible, to the topmost ridge of a steep collecting area.

Further down where the land pays better the area of afforestation may be restricted and in the valley bed it need hardly extend beyond the immediate shores on both sides of the stream. On the other hand, after the torrent is tamed the pile of débris as well as the land won from the river and secured for culture may be entirely released and restored to agriculture as compensation for the worthless surfaces appropriated in the high regions. It is very important then, in the treatment of a collecting area, that the furthest ramifications of a torrent should, first of all and as rapidly as possible, be covered with a forest growth and at the same time the small protective works carried out. The amount of necessary outlay for works in the lower sections of the stream depends upon the effects produced by these newly wooded regions.

It seems especially requisite to undertake such plantings without delay where the corrective works are to be principally of wood so that these may not decay before the beneficent effects of the newly created forest are apparent.

Considering expenditures in this connection, what relation do afforestation and protective works bear to one another in Switzerland? In spite of every effort on the part of cantonal and Federal forestry officials the area afforested with State aid since 1871 only amounts to less than 3 000 hectares, and according to the sum of expenditures the relation of afforestation to corrective works is about as one million to sixty-three and a half million francs.

Compare with this what France has accomplished since 1893. Fifteen million francs have been expended for purchase and forestation of 62,000 hectares of barren land not to mention the many other plantings undertaken by private persons and communities with State aid. Only eight million francs have gone towards works of correction. This amount, together with expenses for roads, transport, buildings, etc. makes only 46 per cent of the total expenditure for constructions and corrections as against 98 per cent consumed by us for similar ends.

Do you not think gentlemen that France has spent her money more advantageously than we in Switzerland? Every outlay for constructive works is like a debt contracted, unless simultaneous forestation is undertaken which will render them needless in the future. The continuous expense of maintenance and renewal corresponds to the interest on the debt. Sums which are spent for the increase of forest area are on the contrary not a debt but capital well invested. From such a policy you may expect not only the most perfect protection, but in the end a considerable and from year to year increasing income.

In regard to the comparative amounts expended in Switzerland for corrective works and afforestation, it must be remarked that if the outlay has not hitherto accomplished its purpose the authorities should not be held responsible. Assistance is forthcoming whenever it is sought and wherever forestation is indicated the necessity of undertaking it is invariably recommended, but I could give you countless examples of communities and corporations to whom the matter of subduing a torrent is a vital issue, who obstinately refuse to resort to cultures on their own ground and property, notwithstanding that most liberal appropriations are available for defraying the expenses.

The cause of the evil lies in the insufficient enlightenment of the people as to the real interests of the country. It seems, therefore, an important and worthy undertaking for the Bern Forestry Society to start a propaganda for the forestation of the collecting areas of our torrents, and for each member in his own neighbourhood to work for the accomplishment of this object.

The Forester.

The Floss, or "Silk-Cotton," of Calotropis procera.

Calotropis procera is a shrub found in the drier parts of India, chiefly in the sub-Himalayan district, from the Indus to Jhelum, in Central India and the Deccan, and distributed to Persia and tropical Africa. *Calotropis gigantea*, a species only doubtfully distinct from *C. procera* and which has the same vernacular names, is recorded as identical in its properties and uses. The sap yields a form of gutta-percha, and is also used as a tan and dye; a manna is said to exude from the plant, the bast fibre and floss from the seeds are well-known fibres, the root-bark and sap are medicinal, the wood is used for gunpowder charcoal, and various parts of the plant are employed for sacred, domestic and agricultural purposes.

These plants, *C. procera* and *C. gigantea*, yield two distinct fibres—(1) a silk cotton from the seeds known commercially as "madar floss" and (2) a rich, white, bast fibre from the bark. The floss is soft, very white and has a beautiful silky gloss; it is employed to some extent like the Dutch "kapok" for stuffing pillows, but has generally been regarded as of too short staple to be spun, although, as regards its possible use in this direction, a Lancashire spinner stated at the time of the Colonial and Indian Exhibition of 1886, that he had overcome the difficulties and was prepared to purchase any quantity. But as the plant is only found wild scattered over a wide area, the supply is limited and irregular. If it can be cultivated there seems to be no reason why a regular supply should not find a market at a remunerative price and at the same time by bestowal of attention to the cultivation and selection of seed, the character of the floss might be improved and its length of staple increased.

The attention of the Scientific Department of the Institute having been directed by the Government of India to the possible utility of this floss, it has been submitted to examination by Mr. C. F. Cross, Scientific Referee on Fibres to the Imperial Institute, and the following results have been obtained. The more important constants of the fibre, which has the chemical characteristics of lignocellulose, are as follows:—

Moisture		9.0 per cent
Ash		3.0 „ „
Hydrolysis	(Alkali, 1 per cent $NaOH$),	26.2 per cent (loss)
	(Acid, 1 per cent H_2SO_4)	24.7 „ „ „
Cellulose		69.8 per cent
Furfural	... ...	19.5 „ „

Mr. Cross states that this floss fibre is an extremely interesting chemical type, containing as it does a very high and, in his experience, unique percentage of furfural. He is of opinion, however, that although use may be found for some applications of floss fibre, its somewhat unfavourable chemical characteristics are not likely to recommend it to the spinner, in view of the present low price of cotton

The floss has also been submitted to the Expert Referee to the Institute on Fibres who has reported that this floss was in considerable demand in the markets a few years ago for fancy textile purposes, but that owing to the difficulties presented by the variations in the quality of the parcels supplied, and to the intermittent supply when requirements arose the material has dropped out of use The quality of the Indian growth has, so far, proved inferior to the product of Java which is probably derived from C *gigantea* and of which small samples have occasionally been received from India The present specimen was of fair colour, of rather short staple somewhat towy in character, and contained an excessive quantity of inferior immature fibre, and seed fragments Many varieties of the floss in question have been dealt with most of them from Calcutta where it is sometimes called 'akund cotton' which were usually inferior to the present sample These samples were sold at as low a price as one penny per pound and there was but little demand for them at that price The trade in this floss might possibly be revived if a moderate and continuous supply could be guaranteed If of good quality, it would realize prices ranging from 4d to 5d per pound (c i f & i terms) In packing for sale, the floss should be handled as little as possible the pods and seeds being entirely removed and the floss left in its natural condition—unopened, any discoloured portions should be removed and forwarded separately The bales received here from Java usually contain 80 to 90 pounds of floss tightly sewn in canvas but not pressed – *Imperial Institute Journal*

A New "Tallow Tree."

The French Journal *Revue Coloniale* gives the following description of a new tallow tree —The *Myristica surinamensis Roland* of Guiana, and the *Myristica Kombo H Bn* of the Congo yield a fatty substance very closely allied to tallow which has caused the name of "tallow tree' to be given them The tree to which we now draw attention however belongs neither to the same species nor to the same family The tallow tree of East Africa must be placed in the family of *Guttiferæ*, at first the name of Stearine-tree (*stearodendron*) was given to it, and this was afterwards changed to Allanblackia The *Allanblackia Stuhlmanni, Engler*, known in Usambara under the native name of Msambo, is a tall tree, whose rather large fruit-buds, fleshy and of a strange shape, immediately attract the attention of the traveller. The fruit which attains the size of a human head, contains a considerable number of seeds, which are extraordinarily rich in a fatty substance. It is stated that the seeds of four of these fruits will yield as much as 1 to 1½ kilogrammes (say 2 to 3 lb.) of fat. This fat is of the same stiffness as tallow, and can be used for making candles. At Bagamoyo indeed, this trade has reached considerable proportions. The wood of the tree which is of a red colour could be utilized in house-building, and perhaps even for cabinet-making.—*Imperial Institute Journal.*

Erythrina indica

Writing to the Journal of the Bombay Natural History Society with reference to a paper by Mr. Woodrow on the plants of a Bombay swamp, Surgeon-Captain Prain remarks:—"I am interested in what he says of Erythrina indica as appearing in your Bombay swamps and as having more the appearance of a wild tree than other examples near Bombay have. The truth is that Erythrina indica is one of the commonest of Indian sea-coast trees all round the found Andamans, Nicobar and Burmese Coasts, and all along the sea-face of the Sunderbuns it is one of the very commonest species but *nobody ever found it truly wild anywhere except on a sea-coast.*' It may interest him to know that the tree is not infrequently in the dry hills of the Prome District in Burma. Kurz (Forest Flora of British Burma I. 369) says "strange enough, this sea-shore tree scantily re-occurs in the dry forest of the Prome District. I have not examined the respective localities, but suspect that there are brine wells or limestone in the vicinity." There is no doubt about its being really wild as it occurs in virgin forest miles away from any village. The tree is also reported to be wild in the Khandeish Dangs and Brandis says that it occurs wild in the Gonda forests of Oudh.

The introduction of Ladybirds and other enemies of Insect Pests.

The Government of Madras has recently had under consideration a proposal made by the Hon'ble Mr. H. P. Hodgson to introduce ladybirds from Australia with a view to the destruction by their means of red spider and scale bugs. Mr. Hodgson has offered to guarantee half the expense incurred if Government will take up the matter.

According to an article which lately appeared in *Nature*, the entire eradication of the white scale insect has been effected in California by the importation from Australia of its ladybird enemy, *Vedalia cardinalis*, and the citrus industry of the State has thereby been saved. In 1891 the same State granted 5,000 dols for the purpose of sending an expert to Australia, New Zealand and the adjacent countries to collect and import parasitic and predaceous insects. The expert chosen was Mr Albert Koebele who had previously introduced the *Vedalia cardinalis*. During the year he was employed he succeeded in introducing 60,000 specimens of different species but principally ladybirds. Most of these have disappeared but a few of them are still abundantly represented in the orchards of California, the most important being three different species of *Rhizobius*. These are said to have already done much good. One species *R. ventralis*, has been distributed in enormous numbers to different parts of the State and in some instances has effected the entire eradication of the black scale in badly infested orchards.

The particular ladybird which Mr Hodgson purposes to introduce is *Chryptolæmus Montrouzieri* which Mr Koebele says has proved most valuable in Honolulu. Mr Hodgson further suggests that as various crops suffer from insect pests and each insect probably has its natural enemy, it would be worth while employing an entomologist to take up the question generally.

The Government of Madras consider that in view of the decided opinion expressed by the Commissioner of Agriculture, Hawaii, that the work of searching for and introducing the natural enemies of insect pests "should be entrusted only to a skilled entomologist, one who has made the life habits of beneficial and injurious insects a special study, lest injury instead of benefit might arise," it is unsafe to apply for or introduce ladybirds from Australia except under the professional advice and supervision of an expert, but that if, when the services of such an expert are procured, the latter advises that a consignment of these insects should be obtained, they will be ready to take the necessary action in the matter and to contribute half the cost as proposed by Mr Hodgson.

We would suggest that before indenting on Australia for new species, the Madras planters should experiment with some of the numerous indigenous ladybirds, which might prove as efficacious as imported kinds.

The Camphor Tree.

An account of the range, cultivation, uses and products on the Camphor tree (*Cinnamomum Camphora*) is given in a Circular (No. 12) just distributed by the United State Department of

Agriculture (Division of Botany) Notwithstanding the comparatively narrow limits of its natural environment, the camphor tree grows well in cultivation under widely different conditions It has become abundantly naturalised in Madagascar It flourishes at Buenos Ayres It thrives in Egypt, in the Canary Islands, in South Eastern France and in the San Joaquin valley in California, where the summers are hot and dry Large trees at least two hundred years old, are growing in the temple courts at Tokyo where they are subject to a winter of seventy to eighty nights of frost, with an occasional minimum temperature as low as 12° to 16 ° F The conditions for really successful cultivation appear to be a minimum winter temperature not below 20° F, 50 inches or more or rain during the warm growing season, and abundance of plant food rich in nitrogen

In the native forests in Formosa Fukienand, Japan, camphor is distilled almost exclusively from the wood of the trunks, roots, and larger branches

The work is performed by hand labour, and the methods employed seem rather crude

The Camphor trees are felled and the trunk, larger limbs, and sometimes the roots, are cut into chips which are placed in a wooden tub about 40 inches high and 20 inches in diameter at the base, tapering towards the top like an old fashioned churn The tub has a tight fitting cover which may be removed to put in the chips A bamboo tube extends from near the top of the tub into the condenser

This consists of two wooden tubs of different sizes, the larger one right side up, kept about two-thirds full of water from a continuous stream which runs out of a hole in one side

The smaller one is inverted with its edges below the water, forming an air tight chamber This air chamber is kept cool by the water falling on the top and running down over the sides The upper part of the air chamber is sometimes filled with clean rice straw, on which the camphor crystallises while oil drips down and collects on the surface of the water In some cases the camphor and oil are allowed to collect together on the surface of the water and are afterwards separated by filtration through rice straw or by pressure

About twelve hours are required for distilling a tubful by this method Then the chips are removed and dried for use in the furnace, and a new charge is put in At the same time the camphor and oil are removed from the condenser By this method 20 to 40 pounds of chips are required for one pound of crude camphor —*Nature*

VII -TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

4th November, 1897

East India Teak —The Dock stock in London creeps up slowly and prices have eased a little in sympathy with the difficulties in the ship building trades consequent on the Engineer's strike The deliveries since the beginning of the year amount to 15 136 loads against 18 297 loads in the same ten months of 1896 In October this year they have been 1 979 loads as compared with 2,033 loads in October 1896

Rosewood East India —Is wanted and good parcels would sell readily and well

Satinwood East India —Stocks are heavy and sales low

Ebony East India —A parcel has just arrived, but there is no other stock

PRICE CURRENT

Indian teak	per load	£9 15s	to	£14 15s.
Rosewood	,, ton	£8	to	£10
Satinwood	, sup foot	5d	to	12d
Ebony	,, ton	£6	to	£12

Denny, Mott & Dickson's Report.

London, 1st November 1897

TEAK —The landings in the Docks in London during October were 2 124 loads as against 924 loads for the corresponding month in 1896 The deliveries from Docks to consumers last month were 1,946 loads as against 2 133 loads for October, 1896 , and the London stocks now show as follows —

Logs	**10 561**	**loads**	**as against**	**7 693**	**loads at the**	**same date**	**last year**
Planks	**2,506**	**,,**	**,,**	**2 120**	**,**	**,,**	**,,**
Blocks	**15**	**,,**	**,,**	**82**	**,**	**,,**	**,,**
Total	**13 082 loads**			**9,895 loads**	**,,**	**,,**	**,,**

The official figures of Stock on 31st ult, do not include a Rangoon cargo of 958 loads arrived but not landed at that date

The demand for rolling stock purposes continues good and notwithstanding the dulness in the shipbuilding demand prices continue very firm. A sharp demand for shipbuildings purposes must be looked for immediately the Engineers' strike is settled, and the consistent reports of short supplies at the shipping ports is another feature tending to harden the market. The stock of bad and indifferent wood however continue to accumulate and this promises to be a weakening feature, however much the moderate quantity of first-class wood may be trusted to command good rates.

MARKET RATES OF PRODUCE

Tropical Agriculturist, November, 1897.

Cardamoms		per lb	3s.	to	3s 1d
Croton seeds		per cwt.	50s.	to	60s
Cutch		„	9s. 3d.	to	32s. 6d.
Gum Arabic,	Madras	per ton	17s.	to	45s
Gum Kino	„	„	£45	to	£55
Indiarubber,	Assam	per lb.	1s. 9d.	to	2s 4d
„	Burma	„	1s. 4d.	to	2s 2d
Myrabolams,	Bombay	per cwt.	4s. 3d.	to	9s.
„	Jubbulpore	„	4s.	to	7s.
„	Godavari	„	3s 9d.	to	5s. 6d
„	Calcutta	„	3s. 6d.	to	5s. 6d.
Nux Vomica,	good	„	7s	to	7s. 6d.
Oil, Lemon Grass		per lb	2⅝d.		
Orchella, Ceylon		per cwt	10s.	to	12s. 6d
Sandalwood,	logs	per ton.	£30	to	£50
„	chips	„	£4	to	£8.
Sapanwood,		„	£4.	to	£5.
Seed lac		per cwt.	70s.	to	80s
Tamarinds (Madras)		„	4s.	to	6s.

APPENDIX SERIES.

OF THE

Indian Forester,

REPORTS BY

E. E. FERNANDEZ, Esq.

Consr. of Forests.

PART I

PART I

FOREST INDUSTRIES.

1. Manufacture of wood-cellulose and wood-pulp.
2. Preparation of tannin extracts.
3. The resin industry in France.
4. The dry distillation of wood with special reference to the manufacture of wood spirits, wood-vinegar, acetate of soda and acetic acid.
5. Wood-paving of streets.
6. Manufacture of wood matches.
7. Management of forests of the cork oak (*Quercus Suber*) and preparation of cork.

I. WOOD-CELLULOSE AND WOOD-PULP.

These two terms are often used synonymously, but it is best to keep them apart, reserving the first for the pure fibrous matter of the wood left after all cementing and impregnating substances, and those contained in the intra and intercellular spaces, have been dissolved out and removed under the action of re-agents, and the other for the mass of almost pulverised, chemically impure fibres obtained by grinding wood into a paste and washing out of this all soluble matters and others that are in a sufficient state of tenuity to pass through the meshes of a fine sieve.

In the case of wood-pulp, as a consequence of the action of grinding, the fibres of the wood are broken up into such short lengths as to be incapable of uniting, by simple interlacing, to form a thin resisting tissue like paper. Hence a certain minimum proportion of the cellulose or other fibrous substance (rag or *esparto* half-stuff) has to be added by the paper manufacturer.

Above this minimum the quantity to be added varies with the quality of paper required. Thus, for the worst kinds of printing paper a mixture of about 15 per cent is sufficient, while a printing paper of fairly good quality and a writing one of inferior quality are obtained with a mixture of only 20 per cent. On the other hand, if a tough, not easily tearable paper is wanted, cellulose with little or no admixture of the pulp must be used. The loose specimens of paper submitted herewith, and those in Herr Ludwig Tuck's interesting pamphlet, illustrate what has just been said.

M. Weibel, the owner of the largest wood-cellulose factory in France, situated at Norvillars, between Belfort and Besançon, spins and weaves the cellulose after subjecting it to a preliminary special treatment, which gives to it the lustre and appearance of worm silk.

EXTRACTION OF WOOD-CELLULOSE.

The problem to solve here is to completely separate from one another the individual fibres of wood and remove from them everything but the cellulose, without tearing or breaking them up or diminishing their elasticity, toughness or tensile strength. Such a result can obviously be accomplished only by chemical means. Hitherto sulphurous acid, in the form of a soluble sulphite or bisulphite, has been found the most effective and convenient re-agent to use. It has no action on cellulose, even at a high temperature and under high pressure. In a closed vessel with wood chips, at a temperature of 108°—110° C., it becomes split up, giving up a part of its oxygen to the lignin, whereby this last is converted into resinous acids, which pass off in solution when the fibres are washed.

Alkaline bases and basic salts also give good results, but they have the disadvantage of acting only at a very high temperature and under a pressure of 2·67 atmospheres, thus creating risk of explosion.

The best woods to use are those which satisfy the following conditions :—

1. They should be soft, but at the same time possess tough, resisting, long, parallel fibres—the finer, the better.
2. They should be as colourless as possible. Those species which have a distinct dark heartwood may of course be employed, provided young stems or branches with little or no heartwood are used.
3. They should not contain too many knots.

It is unnecessary to add that in any case the wood must be perfectly sound, as the least amount of unsoundness means some degree of decay of the cellulose.

The best European wood for the purpose is spruce. Now, as young stems of this species make the best lashing for rafts, and the wood of such stems, when split thin, can be woven into baskets just as easily as split bamboo, it follows that a flexible elastic wood is also one well adapted for paper-making. In Germany no other conifer but spruce is used by the wood-cellulose maker. In the French Vosges, although silver fir is by far the most abundant conifer, it is scarcely ever employed, and yet a strongly resinous wood with a dark heartwood, like Scots' Pine, is used by M. Louis Geisler, owing to the dearness of spruce, which has for the most part to be imported. Near Besançon, however, silver fir is apparently largely employed.

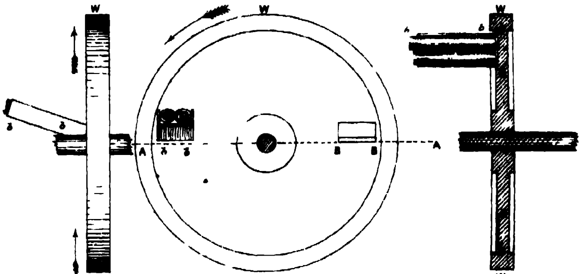
Among broad-leaved species aspen and the white poplar are used in France, both in the Vosges, where there is next to no spruce, and in the Jura, where spruce is abundant. I have been informed that printers are partial to paper containing a certain proportion of aspen and white poplar cellulose, as such paper takes a clearer impression than pure spruce paper. As both these poplars are short-fibred, it would appear that a mixture of short fibre facilitates the printer's work.

I will now describe the process of manufacture.

The wood, which is never less than 3 inches in diameter at the smaller end, is first of all carefully peeled to free it completely of bark. This can be quickly done on a machine consisting of a heavy wheel which is made to revolve rapidly, and is fitted with two sharp blades fixed radially. But hand-peeling is generally preferred, as it wastes much less wood and is also more effective, the machine failing to remove the bark from hollow parts. Barking in the forest is of no use at all, as the wood would have to be shaved again to get rid of mud, dust, grit, etc.

Next, knots and unsound spots are either cut out with an axe, the blade of which narrows and becomes convex towards the cutting edge, or, better still, gouged out with a hand or machine drill.

The wood is then cut up into little pieces small enough to be acted upon, through its entire substance, by the lye in which it is to be digested. This mincing up is effected in France with a machine called a *déchiqueteur*.* WW is a large solid iron wheel about 10 feet in diameter and weighted, like a fly wheel, at its circumference, in order to secure a very high momentum. BB and BB are two sharp, extremely strong blades fixed near the opposite ends of a diameter along one edge of a rectangular opening in the disc of the wheel, the opening being wide enough to allow the billets to be chopped up to pass easily through. These billets (one at a time if thick, two if thin enough) are placed on a sloping sheet-iron bed (bb) and of their own weight slide down against the wheel. The bed rests on an extremely strong solid support, which is not shown above in order not to confuse the sketch. Nor is the floor, which is about 18 inches below the axle of the wheel, represented. The wheel is made to revolve in the direction of the arrow with great velocity. The moment the billets slide forward into one of the openings in



Elevation from side A

Front elevation

Section on A A seen from above

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* I believe the English name is defibrator.

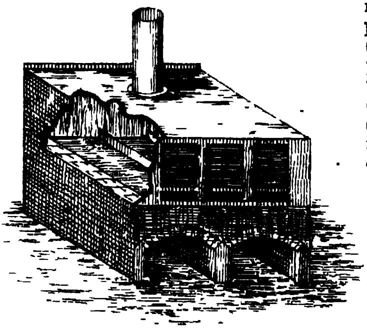
the wheel, the knife catches them before they can slip forward much more than half an inch, and takes off a slice which, owing to the heavy impact and consequent shock, breaks up into numerous chips. The chips fall out, on the other side of the wheel, on to a wooden shoot, down which they slide into an open sac placed at the lower end on the floor below.

The chopping up of the wood is effected with astonishing rapidity with the *déchiqueteur*; but the wood may be reduced in several other ways—(i) by sawing across into slabs of the required thickness and then breaking up the slabs into small fragments with a hatchet or a hammer; (ii) by shaving with a plane or on a lathe; or (iii) by hand chopping with an adze or axe.

The wood is now in a condition to be subjected to the action of the lye or solvent to be used.

The digestion may be effected in boilers over an open fire, but it is best to employ a boiler surrounded with a steam jacket. During the digestion the contents of the boiler require to be constantly stirred. Hence either a revolving boiler should be used or the fixed boiler should be furnished with a revolving agitator. To facilitate and expedite the digestion it should be possible to exhaust the boiler, previously filled about two-thirds with chips, of air before introducing the lye. The result of the exhaustion is that the lye penetrates at once into the wood. The boiler should be heated only gradually.

For the lye the substance now almost universally used is bisulphite of lime, which is easily prepared at the cellulose factory itself, by burning sulphur, or, what is more economical, iron pyrites, in a special oven (see annexed sketch), and passing the gas thus obtained over limestone, over which water is constantly made to trickle, or into lime water in a milky condition.



The oven, represented above, requires to be described. The plinth (about 32 inches high), arches, and side walls are of brick masonry, while the front and back walls and the floor, roof, and chimney are of thick cast-iron. The floor is made to slightly slope forwards. Iron partitions about 4 inches high and running parallel to the brick walls, divide the oven along the floor into 3—6 equal compartments, each compartment having a door in the front wall. Just below the doors small holes are pierced to let in air, and a sliding panel regulates the opening and shutting of the holes according to the strength of draught required, which should be strong enough to prevent distillation of the sulphur, and not so strong as to cause the formation of sulphuric acid. If sulphur is used, from 12 to 14lb are consumed per square foot of the floor of the oven in 24 hours.

As the fumes of sulphurous acid are strongly poisonous, air containing only 0·04 per cent. of them being already difficult to breathe, the limestone, broken up to the size of ordinary road-metal, is placed inside a high narrow tower (like a chimney), so that the whole of the gas may be used up before it can reach the vent. The gas being extremely soluble in water,* care must be taken to keep the stones constantly wet by allowing water to drip on them in a fine shower like rain.

The chimney of the oven is connected with one side of the tower near the bottom. The water, dripping off the stones, carries down with itself calcium bisulphite in solution, and runs out through the bottom of the tower into special tanks.

In his large factory at Kehl, Herr Trick is careful not to let any of the acid escape into the air. Alongside of the usual tower is a second one filled with broken dolomite and into which excess acid from the first, if any, at once passes. Another speciality of Herr Trick's, as may already be guessed, is the use of a mixed lye of the bisulphites of lime and magnesia, and he accordingly puts into the first tower ordinary limestone (carbonate of lime) as well as dolomite. For quicker action he uses tufaceous limestone, which he is lucky enough to find in Baden itself. This composite lye is apparently much stronger than the simple calcium bisulphite lye, since Herr Trick puts into the boiler also whole disks of wood more than an inch high obtained by merely cross-cutting the logs and billets without splitting them. He does not even take the trouble to gouge out the knots, which remain behind on the sieve (called by him *Astfanger* = literally, branch-catcher) when the separated fibres pass through.

The time during which the digestion is carried on varies with the wood used and with the size of the boiler. From 6 to 10 hours are usually sufficient, but M. Weibel of Norvillars, already referred to on page 1, employs boilers of a mean capacity of 77,000 gallons, and he allows 70 hours for the digestion.

The lye, when the operation is over, is of a deep brown colour. It is run out and treated for recovery of the salt.

As sulphurous acid acts on iron and copper, the boiler requires to be lined with a metal capable of resisting it.

The wood is now nearly pure cellulose with a little mechanical admixture of certain impurities. The pieces or chips still retain more or less their original form and size, but very little force suffices to break them up into their separate component fibres. If, however, a fixed boiler with a mechanical agitator has been used, the pieces are already more or less thoroughly broken up before leaving the boiler.

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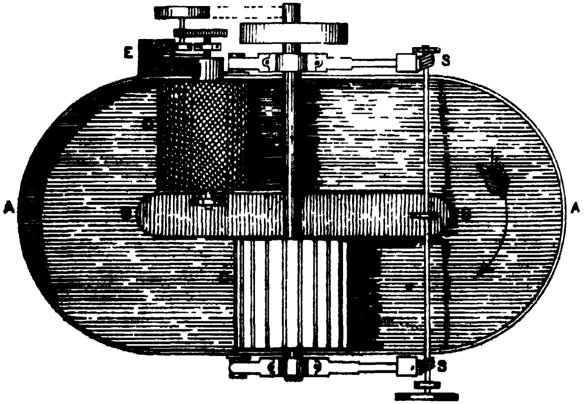
* 1 litre of water dissolves at 0° C. 79·8 litres of the gas, at 10° C. 56·6 litres, and at 20° 39·4 litres.

A revolving boiler can be emptied without difficulty. Herr Trick empties his boilers, which are fixed and horizontal, through a large circular hole in the bottom. The contents run out into a tank below. The lye is drawn off through a pipe. Fresh water is introduced and drawn off in the same way in order to remove most of the remaining lye, and the cellulose is carried away by means of a chain of buckets, working on the principle of a Persian Wheel, into horizontal cylinders inside which a strong axle armed with numerous long blades is constantly revolving. These tear up the disks of wood, separating the digested fibres from the undigested hard knots. As the broken up mass passes out, the latter remain behind on the *Astfanger* already mentioned above.

The next operation is to thoroughly wash the cellulose and reduce the fibres, now of different lengths, to short equal lengths, so as to form a homogeneous mass. This is done in the apparatus here represented, termed in French a *pile de concassage*.



AA is a large elliptical iron trough with a flat bottom. BB is an iron wall fixed in the centre, so that the space between it and the sides of the vat becomes an elliptic canal of uniform width. CC is a strong wheel armed with 50—70 sharp steel blades arranged in pairs and fixed on the circumference parallel to the axis.

Immediately under the wheel, in the bottom of the trough, are fixed 8—14 similar blades parallel to one another, but in planes forming a slight angle with the blades on the wheel. The supports on which the axle-tree of the wheel rests can be raised or lowered by means of the endless screw arrangement SS, so that the distance between the blades of the wheel and of the foot-plate can be perfectly adjusted. The object of the non-parallelism of the one set of blades to the other is to make them more effective in rending asunder and cutting up the cellulose fibres.

The canal being filled with water and cellulose from the boiler, the wheel is made to revolve from left to right, thus setting in motion the water and cellulose in the opposite direction The blades of the wheel, acting like paddles, draw the cellulose forward and pass it between themselves and the blades of the foot-plate. The wheel is driven so as to make 100—200 revolutions a minute, according to the fineness of the cellulose required.

As the cellulose fibres, besides being separated and cut up, have also to be thoroughly washed, the water has constantly to be renewed. This is effected by the washing drum DD, which carries away the impure water as fast as fresh clean water enters the trough through a feed-pipe. The two faces of the drum are completely closed with wood or iron plates, while the circumference is formed of finely perforated metal, through which only water containing the impurities in solution or suspension can pass. Inside the drum is fixed an Archimedean screw or an arrangement of buckets on the principle of the Persian wheel, in order to carry off the water that enters through the perforations. The water disappears finally through the funnel E attached to a waste pipe

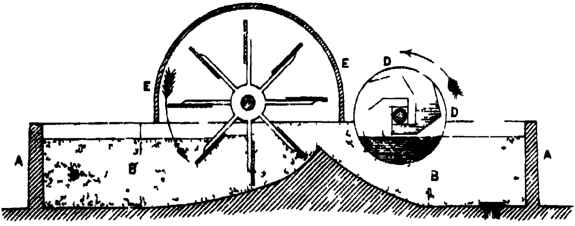
The washing must at first be effected with hot water until the remains of the lye and the encrusting matters of the original wood have been completely removed.

The movement taken off the washing-drum arrangement regulates exactly the inflow of fresh water, which is made to enter to the right of the drum in order that it may make a complete circuit of the canal before it can enter the drum.

The next process is bleaching. It can be dispensed with for the manufacture of papers which are not required to be perfectly white, as the digestion alone with the sulphites yields a nearly white cellulose when light-coloured woods, like spruce, silver fir, poplar, etc., are used (*see* specimen of unbleached specimen accompanying, and compare it with the bleached samples).

The bleaching substance used is chloride of lime, to expedite the action of which a slight addition of sulphuric or hydrochloric acid is advisable, otherwise the process is a very slow and tedious one.

The bleaching may be effected by placing the cellulose loosely in vats with perforated bottoms and constantly moistening it from above with the bleaching fluid, which then passes through the mass and drips out from below but the result is never uniform, and it is better to use a special apparatus, a convenient pattern of which is shown in the following sketch:—



AA is a trough of the same shape as that represented on page 6, and built of concrete, cemented bricks or wood, and of a capacity of 100—200 gallons The place of the cutting and rending wheel is taken by a wheel with large paddles, and instead of the blade-bearing foot plate, the floor of the canal is raised, so as to subject every portion of the mass to be bleached to thorough agitation and air action. The wheel makes 200—300 revolutions a minute

The washing drum is placed at the end opposite to that in the apparatus on page 6 In order to show the drum, a part of the wall built on the middle line of the ellipse is represented as removed The arrangement in the inside of the drum shown in the sketch above is more convenient than Archimedean screws or the principle of the Persian wheel. Partitions running through the entire length of the drum divide the space inside into buckets Each bucket, as it rises out of the bleaching mass, brings up a certain quantity of water The drum continuing to turn, the water ultimately reaches the end of the bucket, whence, through a hole in the further side of the drum, it flows out.

EE is a metallic or wooden cover placed over the paddle wheel to keep in the splash After the operation the trough is emptied through O

Usually 25—30lb of chloride with 150 gallons of water are used with 100lb cellulose (air-dry weight)

The cellulose is now ready for delivery to the paper-maker. For facility of packing, transport, and testing for quality, it is made up into large thick sheets like card-board, which are hung up to dry in sheds with open trellis-work walls

With the use of sulphites, especially that of magnesia, the yield of cellulose is usually between 50 and 60, and may even run as high as 66 per cent of the weight of the wood. Recently in Northern Germany sodium sulphate has been tried instead of caustic soda, which the sulphites have supplanted. The sulphate has its great cheapness to recommend it, but I can say nothing more regarding it, as I have been unable to visit a factory using this salt.

I possess no certain data regarding the cost of extracting cellulose, manufacturers having been chary about giving me information. In Saxony, where only wood-pulp is made, a paper manufacturer informed me that the cellulose he mixed with his wood-pulp came from Baden and cost delivered at his factory 9 shillings per 100lb. And in France, M Bichelberger of Clairefontaine, Etival, who makes both cellulose and paper, told me that the cost of the cellulose he used figured in the cost of his paper in the proportion of 60 to 100. The average price he realises for his paper is just over 18 shillings per 100lb. Putting his profits at 5 per cent (the paper and cellulose business is not a very paying one in France), the figure for the cellulose works out at 10 shillings per 100lb. This is a higher figure than the cost of Baden cellulose in Saxony, but the German product is notoriously cheaper than the French product, as the next paragraph will show.

At the commencement of the Nineties the French wood-cellulose and wood-pulp industries had reached so low a stage that the Syndicate of wood-paper stock manufacturers of France addressed a petition to their Government asking it to protect them against foreign importations by levying a tax on these and removing the duty on foreign wood imported expressly for the manufacture of paper stock. They complained that while France exported only ½ per cent of its importations, these latter were constantly on the increase. From 211,680,000lb in 1888 they had risen to 251,370,000lb in 1889 while the home manufacture totalled only 143,525,000lb. In 1888 Norway sent to France 49,225,000lb, Sweden 24,255,000lb, Germany 33,073,000lb, and Switzerland 26,460,000lb.

The result is that the following customs dues are now levied —

On wood-cellulose	*Tarif général*	2 50	*tarif minimum*	2 fr	per	100 kilogs.
„ wood pulp, dry	„	1 50	„	1	„	„
„ „ wet	„	0 75	„	0 50	„	„

while the rates on wood suitable for manufacturing these products have been reduced, respectively, to 3 and 2 centimes per 100lb. Notwithstanding this protection of the home industry, the foreign products still sell cheaper.

*MANUFACTURE OF WOOD-PULP

This is often termed *mechanical* wood pulp in contradistinction to the other, which is called *chemical* wood pulp. But the terms I have used are more logical, as the latter being entirely fibrous, is no pulp at all.

Whatever the details of procedure, the wood is always ground directly into a paste on a grindstone or on a rough iron wheel (very exceptional), or first torn up into small shreds with plenty of water with powerful machines and then ground fine between two grindstones. In the latter case the product is more fibrous and therefore better adapted for the paper maker, but, on the other hand, the special machines required are costly both to purchase and keep in repair, and the powdery product of the direct grinding is found to be quite good enough for all purposes when mixed with a sufficient amount of cellulose. Accordingly the system of direct grinding is now all but universal.

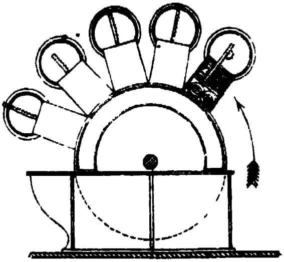
The pulp may be required (i) for paper stock and for the manufacture of xylonite, etc., which form an extremely good substitute for ivory and bone, or (ii) for cardboard, for the manufacture of boards, mouldings, buckets, etc., and for filling in steel skeletons of wheels, etc. In the former case the pulp has to be fine and of perfectly even quality, and accordingly all hard knots must be previously removed, the wood should not be pressed to much against the grindstone, which should revolve very rapidly, and lastly, the product of the first grinding must be refined, *i.e.*, ground over again between two stones like flour. In the latter case, if only thick card-board is to be made, or the pulp is to take the place of wood, not a single knot need be removed, and the refining process may be dispensed with: moreover, to render the fibres more easily separable (thus quickening very appreciably the process of grinding) and to preserve and even increase their strength and toughness, the wood is previously split and steamed for several hours previous to being ground. In M. Boucher's factory at St. Amé in the Vosges the steaming is continued for 14 hours at a pressure of 57℔ to the square inch. This prolonged steaming has the effect of making the wood (spruce of the previous year's felling) as brown as oak heart-wood, but rendering the fibres so easily separable and strong that they can be pulled off in thin strands like hemp, and can, like hemp, be twisted without breaking (*see* short strand accompanying this report). This accounts for the toughness and leathery texture of M. Boucher's cardboard, of which I annex three samples.

It will suffice to describe the process in which only the action of grinding is employed.

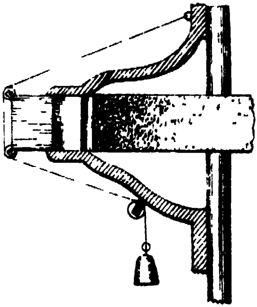
The grindstone is merely a cylindrical block of the usual sandstone about 4 feet in diameter and 1½ feet high, and fixed on a vertical or horizontal axle-tree. The grinding surface has to be roughened every 1—2 days. The wood is best ground against the circumference of the block, as it is there that the velocity is greatest and is the same for every portion of the wood under treatment. Moreover, it is only by this means that the stone is made to wear uniformly.

The wood is always placed so that its fibres are parallel to the grinding surface, against which it is pressed and pushed forward either by a rack and pinion arrangement, or, better still, because then the pressure is constant and uniform and self-acting, by suspended weights.

Both these systems are shown below. The pressure required varies between 11 and 22℔ to the square inch, according to the hardness of the wood and the coarseness of the pulp to be obtained.



Vertical Mill, with Rack and Pinion arrangement for regulating pressure.

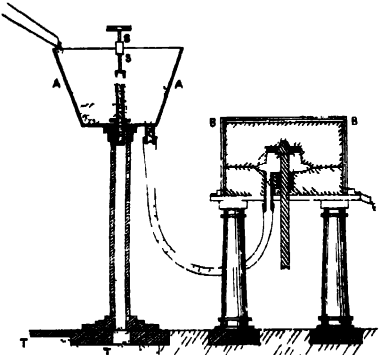


Horizontal Mill, with weight pressure.

Water is made to flow constantly over the stone not only to soften the wood, but also to carry away at once in suspension the particles ground away. For pulp for boards the stone makes about 80 revolutions a minute: for pulp for paper the speed may be double.

From the grinding mill the water containing the ground wood passes on to a wire sieve which retains all chips and large particles. These are, in the French factories I visited, ground up again in mills similar to mortar and cement mills, and when fine enough, are returned into the straining box but, I imagine, they yield stuff fit only for card-board and other employment not requiring fine uniformly ground material.

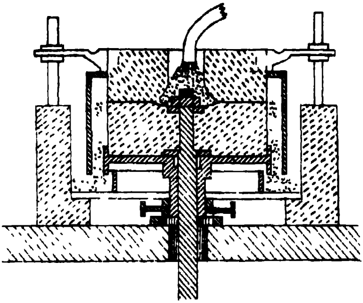
What has passed through the straining box is run into a tank furnished with a mechanical agitator to keep the wood particles constantly in suspension. From this tank the liquid, pumped up, if necessary, passes into the refining mill, where the wood particles are reduced to uniform size and thoroughly freed from all encrusting and impregnating matters.



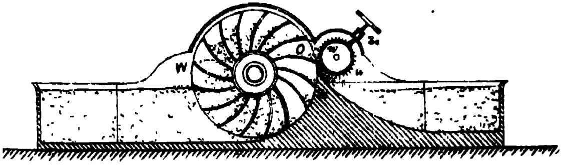
Refining Mill.

A convenient pattern of refining mill is represented opposite. AA is a cistern into which the water containing the wood particles in suspension are constantly pumped up from the tank TT below. The cistern is supported on a hollow pillar open at both ends, the upper being fitted with a telescopic tube *tt*, which can be raised or lowered by means of the screw *s* and is perforated near the top. The object of this tube is to regulate the height of the contents of the cistern. A pipe fixed to the bottom of the cistern connects the cistern, by means of an India-rubber or leather tube, with a metallic tube passing through the nether millstone, which is of course fixed. The two stones are in contact for only about the outer half of their radius, being hollowed out slightly in the middle. The rapidity with which the wood particles pass out from between the stones, *i.e.*, the length of time during which they remain subject to the action of the stones, depends on the height of the liquid in the cistern AA. The higher it stands, the greater is the pressure exerted in the hollow between the stones and the more rapid the exit of the wood particles. BB is a movable wooden cover placed over the stones to confine the splashing of the liquid leaving them.

The adjoining sketch represents another pattern of refining mill, in which the stuff to be refined enters from above, and it is the nether stone which revolves.



The refined pulp is at once made up into thick sheets or boards for export, or if paper is made in the same establishment, it is deprived of its water and mixed in the required proportions with cellulose preparatory to being formed into paper. In M. Louis Geisler's factory at Les Chatelles near Raon l'Étape, this preliminary refining is omitted, and the stuff from the grinding mill is mixed directly with the cellulose in the paper-maker's refining apparatus, which effects all the refining required and is represented by the sketch below.



It is exactly like the apparatus figured at page 8, except that the wheel and foot-plate are replaced by another arrangement and the floor of the canal is raised in front on the right. WW is a wheel divided by curved paddles into a number of buckets which carry up the stuff in the canal and discharge it at O, where it passes between the small wheel *ww* armed with numerous close-set sharp thin blades and the foot-plate *fp* similarly furnished. The wheel WW is about 4 feet in diameter and makes one revolution per minute, while the armed wheel *ww* makes about 250 in the same space of time. In this way the fibres are all cut and reduced to the necessary fineness for the quality of paper required. By means of the screw *sc* the wheel *ww* can be raised away from the foot-plate, so that when the half stuff has been sufficiently reduced it can still be kept in circulation to become thoroughly mixed. It is at this stage that size, kaolin, powdered gypsum, etc., are introduced to increase the weight of the paper, and that colouring matters are added when coloured paper is required.

Through the great kindness of Herr Oscar Bretschneider, owner of a wood pulp factory at Sehma in the Erzgebirge and of Herr Ernst Hofmann, machine manufacturer of Niederschlema, both in Saxony, I am enabled to give here the figures of cost and outturn of a factory disposing of a fall of water yielding a force of 100—120 horse-power:—

Cost of Machinery.

ITEMS.				COST.	
Running Number.	Number.		Weight in lb	Per each.	TOTAL.
				£	£
I	3	Vertical grinding mill, width of grinding surface 20 inches, complete, save stones	35,310	100	300
II	1	Wooden tank for collecting stuff from grinding mill	154	2½	2½
III	1	Straining box, wooden sides, iron frame, copper bottom and eccentric driving gear	550	15	15
IV	2	Refining mill, complete, save stones .	6,600	45	90
V	3	Straining box with perforated copper bottom for stuff leaving refining mill	5,050	30	90
VI	1	Agitator for masonry vat to hold refined stuff, complete with driving gear .	1,700	21	21
VII	2	Machine for forming sheets of pulp 52 inches wide, complete but without felting	11,000	79	158
VIII	1	Pump for half stuff, diameter of piston, 5·9 inches	1,320	26	26
IX	1	Rotating pump for water . . .	990	34	34
X	1	Grappling irons to hold stones of refining mill, with carriage	286	8	8
XI	1	Elevator for passing up wood from ground floor to floor of grinding mill.	1,012	22½	22½
XII	1	Circular saw, complete	440	17½	17½
XIII	1	Iron water-tank, 440 gallons capacity .	880	8	8
XIV	...	Gearing for transmission of force @ £1 per 100lb . . . . ,	12,500	.	125
XV	3	Grind stones for grinding mill . .	5,720	5	15
XVI	2	Pair grind stones for refining mill .	6,600	7½	15
XVII	...	Copper water-pipes . . about	410	...	20
XVIII	2	Felt sheets	...	2¼	4½
XIX	1	Leather belt for elevator . . .	...	2	2
XX	1	Turbine for a fall of 23 feet and a water-supply of 53 cubic feet per second, complete . . . . . about	15,400	225	225
XXI	...	Belting for driving machinery . .	...	...	100
		TOTAL . .	105,992	...	1,299

The above prices are exclusive of transport and packing. Many of the apparatus could be made in India itself. The freight to Bombay or Karachi *viâ* Hamburg, at the rate of 26*s.* a ton, would amount to about £65, so that delivered in Upper India the total cost of the machinery would come to little short of R28,000. Buildings, setting up, and works for leading the water would cost approximately R32,000. Thus the total outlay would be R60,000.

Herr Bretschneider, whose factory contains almost the same amount and style of machinery, estimates that in a working day of 24 hours the outturns would be as follow, according as pulp for paper or cardboard was required :—

Wood consumed		Yield of pulp.		
Quantity, cubic feet.	Weight, lb	Dry weight, lb	Percentage of weight of wood.	Average yield in dry weight per cubic foot of wood.
163—177	11,025	3,675 or	33⅓	21·7
184—204	13,230	4,410	33⅓	22·8

To serve the machinery, and bark and cut the wood, two relays of 1 foreman and 6 workmen each are sufficient. With Indian labour these numbers would have to be quadrupled. On the other hand, the wages would be less than a quarter of that earned by German workmen.

The present prices realised by Herr Bretschneider are—

for pulp for paper making 4·08 – 4·54 shillings per 100lb dry weight,
and
for pulp for cardboard making 3·63 – 4·08 shillings per 100lb dry weight.

When the paper manufactory is in the vicinity, or the paper-maker takes delivery at the wood-pulp factory itself, the sheets of pulp are delivered wet, and the convention is adopted that 3lb of wet pulp = 1lb dry.

The prices realised this year in the forest for spruce pieces suitable for the pulp-maker have been as follows :—

Pieces 11½ feet long and 5-6 inches middle diameter . 4·0*d.* per cubic foot solid.
Do. do. 3-4½ do. do. . . 3·7*d.* do.
Billets 40 in. long and from 3 – 6 in. middle diameter 17*s.* per 100 stacked cubic feet.

In India the wood delivered at the factory would cost at least 50 per cent. less than the above prices.

It is interesting to estimate the probable earnings and out-goings of a mill erected in India on the plan of the one for which figures of cost and outturn have been given above, assuming that only pulp for paper is made.

The daily expenditure would be—

	R	a.
140 maunds wood at 3 annas	26	4
3 foremen at R1 on an average	3	0
24 workmen at 5 annas	7	8
Oil, lubricants, etc.	1	4
Total per day	R38	0

The daily take-in, supposing that the 100lb of pulp sold for only R2, would be, for 3,650lb, R73 Thus the daily excess of receipts over expenditure would be R35 Reckoning 300 working days in the year, the yearly excess would amount to R10,500

We may safely estimate the average life of machinery, buildings etc, at at least ten years The cost of renewal R60,000, spread over ten years would be R6,000 a year Thus there would be an annual profit of R4,500 or 7½ per cent. on the original capital outlay of R60,000

In the preceding calculation the most adverse conditions have been assumed, so that in reality the profits would not be less than 10 per cent

Herr Weidenmuller in Antonsthal near Schwarzenberg in Saxony makes both wood-pulp and paper He enjoys the advantage of a fall of water of 131 feet with an outflow of 53 cubic feet (=331¼ gallons) per second, yielding 600 horse-power A part of this power is of course consumed by the paper-making machinery yet with three large horizontal grinding mills he can use up 530 cubic feet of wood in a day, or three times more than the mill for which estimates have just been given It is thus evident that with more than 1[illegible]0 horse power the outturn would increase in greater ratio than the expenditure on labour and machinery, the two most costly items, so that the profits would be very much more than 10 per cent In the Himalayas a fall of 130 feet could be obtained almost anywhere

And indeed it is in the Himalayas, where actually nearly all our fir trees are either killed standing or are allowed to die and rot in the forest, that wood-pulp factories would be established with great benefit, not only to the exchequer and to the wealth of the country, but also to the forests themselves, for at present cleanings and thinnings are out of the question, and even trees of exploitable size are allowed to occupy uselessly space in the forest, because no one will take them even gratis. If Government cannot induce private enterprise to undertake the business, then it should establish a factory or two to lead the way. Such factories would so soon become a patent success that they could be profitably sold to private persons or companies after five years of State management They would be the commencement of an enormous industry, for with our cheap labour and cheap raw material, we could not only drive all foreign-made paper out of India, but export several hundred million pounds of pulp, as well as of cellulose We have here an opportunity of utilising every year at least 10,000,000 cubic feet of wood that at present goes to pure waste and embarrasses the treatment and management of our forests

In the forests in the plains also there are many species which have little or no value, but which may prove to yield good material for cellulose or wood-pulp, such as the Bombax, species of *Lauraceæ*, *Sterculiaceæ*, etc We know that the genus *Picea* is excellent for the purpose Hence factories established for our spruce are sure to be successful, and at these factories, various other likely woods could be tried and thoroughly tested at little or no expense

II PREPARATION OF TANNIN EXTRACTS.

Under the name of tannin or tannic acid are included a number of different but closely allied substances widely distributed throughout the vegetable kingdom, which all agree in this one particular that they are greedily absorbed by the raw hide of animals, forming with it leather. They are contained in abundance in galls, in certain fruit, such as that of *Terminalia Chebula*, *T. citrina*, *T Bellerica*, *Phyllanthus Emblica*, etc., in the leaves of some trees, such as *Sumach* and *Anogeissus latifolia*, in the wood of most trees possessing a durable heart-wood, such as oaks chestnuts, Acacias, sâl, etc , and last, but not least, in the bark of many trees and bushes, such as oaks, babul, sâl, *Terminalia tomentosa*, *Soymida febrifuga*, spruce, *Pinus longifolia*, *Cassia auriculata*, etc

Galls, fruit and leaves are easily exportable in a dry condition, but wood and bark are both bulky articles to transport over long distances Moreover, in Europe the old system of tanning by stratifying hides alternately with layers of coarsely ground bark, a system which occupied from one to two years before the leather was ready, has been rapidly giving place to tanning with liquid extracts, which have the great advantage of penetrating the hides quickly and shortening the process down to a few weeks. The question, therefore, is to turn to account the enormous quantities of bark and wood which at present go to pure waste in our Indian forests and to convert them into tannin extracts for export to Europe and even for use in the country Under the old system of tanning, Europe had in her cold climate an advantage which forbade all Indian competition in the preparation of leather. The native system of sewing each hide into a bag and filling it with tan, besides not giving the hide enough time to absorb the tannin thoroughly is much too slow, cumbrous and space-demanding to have ever had any chance of producing an article fit to compete against the European one. But now that the use of liquid extracts has shortened the process of tanning so considerably, it seems absurd that India should export raw hides and not leather.

Professor Henry of the Nancy Forest School has shown, as the result of careful and repeated analyses, that in the common European oak the bark contains most tannin, heartwood coming next, with the sapwood a very bad third—so bad, indeed that it would be an advantage if the sapwood could be got rid of by some cheap process when preparing the extract. The bark of the root stock is richest in tannin, the butt-end of the trunk being only a little behind it, while at the top of the trunk the bark contains hardly more tannin than the outer layers of heartwood. As regards the heartwood, the richest portion is that in the butt-end; moreover, the quantity of tannin diminishes from outside towards the centre of the tree The heartwood of the larger branches contains more tannin than that of the top of the trunk. The very small branches and twigs, being nearly all bark, contain as much as the heartwood of the base of the trunk The wood of coppice-grown oak is richer in tannin than that of high-forest grown oak, and generally the broader the annual rings are, the larger is the quantity of tannin. Also oak grown on limestone soils yields more tannin than oak from a soil deficient in limestone

Another interesting result of Professor Henry's experiments shows that the tannin in the bark and sapwood deteriorates and disappears much more rapidly than that in the heartwood: in the first two it exists in the form of amorphous granules, which, in contact with water, first of all break up into minute globules and form an opaque mass, and finally become completely dissolved, whereas in the heartwood the tannin is found as a homogeneous deposit impregnating the membranes not only of the medullary rays, but also of all the fibrous tissues, and in this condition is better preserved Even fossil oak wood contains some tannin, but fungi destroy the tannin completely, wood suffering from red rot containing no tannin at all

It is very desirable to have similar analysis made of our Indian trees, which contain sufficient tannin for the leather industry, but in the meantime we may presume that what M Henry has found out for the common European oak is more or less true of all trees

I will now proceed to describe, first, the process of extraction treated in a general manner, and then briefly some of the more usual processes employed.

METHOD OF EXTRACTION

I GENERALITIES

Whatever the special method employed, the following is the order of the processes to be gone through :—

(1) The wood or bark must be chopped up or shaved fine transverse to the grain, so that the fibres and vessels may be cut across

(2) The chips or shavings, as the case may be, must be macerated or subjected to the action of hot-water or steam, so as to yield an infusion or decoction As all natural waters contain lime, and lime diminishes the yield of tannin, either distilled water must be used (expensive) or the water should be mixed with a small quantity of sulphuric or oxalic acid, in order that the lime may be precipitated, excess of acid being afterwards got rid of by the addition of an alkali in the form of a carbonate or caustic.

(3) The extract should next be cleared of the colouring pectosic and other matters in suspension This is done either by treating with blood or any other albuminous substance, such as the coagulum of casein (blood has hitherto given the best results), or by filtering through animal charcoal (very wasteful, as the charcoal absorbs a large proportion of the tannin), or by the addition of metallic salts, or by centrifugal force (on the same principle

as that of the cream separator) Each and every system necessarily involves some loss of tannin

(4) Mechanical filtration, preceded, if necessary, by decantation.

(5) Concentration to the degree required, if a liquid is wanted, or reduction to an earthy form like cutch. In either case the pneumatic process should be used

II SPECIAL PROCESSES

It will suffice to describe here five processes all of which may be easily employed in India and require no expensive or special plant that cannot be made in the country itself

1 *Gondolo's Process*

The chips or shavings are macerated, with or without the application of heat, in water, to which sulphuric acid has been added at the rate of 6 grammes to a litre The extraction of the tannin being complete, the infusion is treated with sodium carbonate, 1 gramme for every 6 grammes of acid used A precipitate forms which is got rid of by decantation

The extract thus obtained is not highly coloured but in case a lighter-coloured and perfectly limpid fluid is required, clarification must be undertaken with a coagulating substance This latter must be mixed with the infusion at a temperature not exceeding 45° C. The temperature should then be quickly raised, the mixture being constantly and energetically stirred Care must, however, be taken not to allow the temperature to exceed that necessary for coagulation, otherwise the albumen will remain in suspension and fail to absorb the colouring matters As soon as coagulation is complete, the liquid must be allowed to cool After a rest of about an hour it is drawn off and filtered and then concentrated to 30 to 45° Baume, according to requirements. The extract is very rich in tannin, is extremely soluble and is of the colour of honey

2 *Another Process*

When the wood or bark used is of a very deep colour, a slightly different process has to be employed

Macerate in water, adding at any time 20 grms blood for every kilog of bark and wood and keeping the temperature well below 80° C. When the maceration is complete, the temperature of the liquid is to be brought down to about 50°C, and 1 grm of carbonate of soda or of another alkaline salt and 15 grms of blood added to every litre of the liquid. The temperature should now be raised, whilst constantly stirring and gradually adding 6 decigrammes of sulphuric acid for every litre of the infusion The result is that a flocculent mass at once forms in the liquid, consisting of lime salts and colouring matters with the albumen

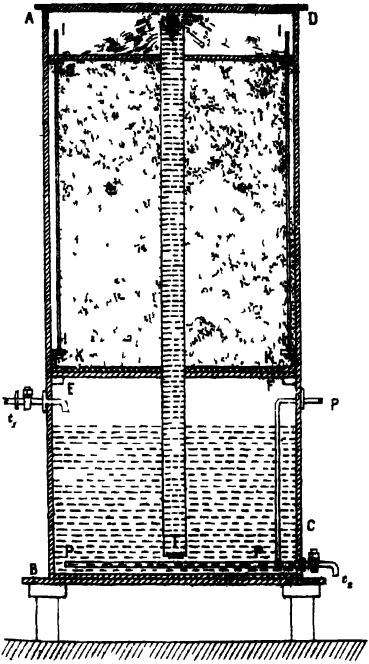
Cool, decant and concentrate as before.

3. *A Third Process.*

This is a slight modification of the preceding, a sulphite or bisulphite being substituted for the sulphuric acid and added *during*, not *after*, the maceration. The salt is decomposed, tannates and free sulphurous acid being produced, the latter of which acts as a decoloriser, becoming thereby changed into sulphuric acid, which precipitates the lime salts in the water and prevents their alkaline action on the tannin. The tannates or free sulphite or bisulphite, as the case may be, that still remain unused in the liquor, are got rid of by the addition of sufficient sulphuric acid. Although up to this no blood has been used, the extract is less highly coloured than that obtained by the immediately preceding method.

To decolorise still further, proceed to coagulate with blood, and decant, filter and concentrate as before.—The liquor thus obtained is of the colour of pale honey, and is so limpid that it enters the thickest hide rapidly and converts it into leather in the course of a few days.

4. *Villon's Process.*



For this process a special, but very simple apparatus is required (see sketch opposite). ABCD is a large square copper or brass vessel about 7 feet high and 3 feet side, divided by the removable cross-plates EFGH, into three compartments. KK is a false bottom of very stout wire gauze, which can be pulled up by means of four rods II, II (only two can be shown in the sketch) when the vessel is to be emptied.

Each of the plates (EF, GH) has 250 circular perforations about two-fifths of an inch in diameter.

TT is a tube of about 3 inches bore and about 6 feet long, which passes through the centre of both moveable plates and is held in place by the lower plate at such a height that its lower extremity is only a few inches above the bottom of the vessel, while the upper extremity projects a little beyond the upper plate

PPP is a pipe through which steam is introduced into the lowest compartment of the vessel, while t_1 is a tap through which fresh water can be let into the same compartment, and t_2 another tap through which that compartment can be emptied

The height of the lowest compartment is about 28 inches, that of the highest about 6 inches

To set the apparatus in operation, the middle compartment is filled tight with the chips or shavings of which the tannin is to be extracted, and distilled water is introduced into the lowest compartment up to a few inches below the upper level of the pipe PP Steam is now let in. The water soon boils and under compression of the steam in the space above it, is forced up through the central tube TT into the highest compartment whence it enters the middle one below and finds its way back into the lowest compartment carrying away with it in solution extractive matter from the chips or shavings In this way a continuous circulation of the water is set up, and in about 6 hours the extraction is complete

By working a battery of several such vessels so connected with one another that the extract from the first, when the shavings have been sufficiently exhausted, can be turned on, through a tube furnished with a tap, from the tube KK into the uppermost chamber of the second vessel, and so on up to the last vessel, a liquor of great strength is at once obtained which requires very little concentration

The advantages of this system are · (1) that the strongest possible extract is obtained with a given limited quantity of water,* so that the labour and expense of concentration is very appreciably diminished, (2) that the liquor is light-coloured and fairly clear, and hardly requires special bleaching if the wood used does not contain a dark dye, (3) that it exhausts the wood of all its tannin, and (4) that the extract contains less gallic acid and gallate of tannin than that obtained by any other process Moreover, as no chemicals are required and the entire process is within the comprehension of the lowest intelligence, the method is specially adapted for employment in our Indian forests, however remote. It would suit cutch manufacture perfectly.

The remark may here be made that there seems no reason why the vessel as well as the partitions should not be of wood, which would not only be much cheaper than metal, but also retain heat better and have no injurious effect on the tannin. Even the wire gauze sieve could be replaced by a wooden trellis frame covered over first with bamboo matting and then with stout cotton drill, which would filter as effectively as the finest wire gauze

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* When chestnut wood which contains 5 to 6 per cent of its weight of tannin, is used, the liquor obtained by decoction in a single vessel marks 5° 6° Baumé and contains 5 per cent of tannin

5 *Luc's Process.*

M. Luc owns several large tanneries, one of which is at Nancy. He employs only oak, not only because oak liquor produces firmer leather and is more easily rendered lighter coloured than chestnut extract, but also because the tree is more widely distributed in France and therefore more easily procured He uses only root-stocks, butt-ends and branches, *i e*, such pieces as are useless for timber, but he rejects everything that measures less than 4 inches in diameter at the small end His wood costs him about 22½ shillings per 100 stacked cubic feet delivered at the tannery

At first M Luc used to have the wood barked on the express advice of the chemist who invented the system employed by him, but he found the cost of barking very heavy and gave it up. Since doing so, the liquor he obtains is richer in tannin and is more easily made light coloured

The wood is reduced to shavings less than one-twelfth of an inch thick The decoction is effected in wooden vats, each taking nearly 6,200lb of chips, with boiling water which is kept in constant circulations The vats are connected together so that the liquor from one passes into another holding fresher chips. When the liquor marks 3° Baume, it is run into a large wooden barrel containing a serpentine tube through which cold water is constantly running As soon as the temperature of the liquor has fallen to 30° to 35° C, blood is added with a little sulphuric acid The temperature is then raised to 60°—65°C to coagulate the albumen of the blood. By this clarification the density of the liquor is reduced to 2° Baumé Concentration is now effected by the ordinary pneumatic process until the areometer marks 20° to 25°.

This extract is not used by itself, but is only added gradually to strengthen the ordinary tan liquor in which the hides are soaking.

The gallon weighs 12 lb and sells at 23½*d*. Even at this rate the profits are very high, and M Luc is driving a roaring business.

The exhausted chips are used as fuel for generating steam for the machinery and other purposes, special grates being used which do away with the necessity of previously drying the chips.

III. CONCLUDING REMARKS.

In India we could employ not only wood, but also barks for the preparation of tanning extracts. One of the functions of the Forest School at Dehra Dun should be to analyse for tannins the bark and wood of all our likely species. The system of effecting analyses with the help of students, which was in force during Dr Warth's tenure of the Instructorship of Natural Sciences, should be resumed, especially as there is now an Instructor to spare during the open season. To assist the Instructor only the more intelligent students, who have shown a bent for chemistry, would be selected.

It will be remembered that Captain Wood, late Conservator of Forests of the Oudh Circle, made a solid extract of sâl bark which he tried to get accepted at Cawnpore and by tanners in England. The experiment was not successful owing, no doubt, to the extract containing colouring matters and other impurities, and probably also to being prepared at too high a temperature; but the venture certainly deserves being repeated, not so much in order to make the preparation of the extract a departmental business, as to attract and invite to it private enterprise.

III. THE RESIN INDUSTRY IN FRANCE.

The only tree that is worked commercially in France for resin, because it yields the product in sufficient abundance for an extended industry, is the cluster pine (*Pinus Pinaster*, gallice, *pin maritime*).

This pine grows spontaneously and gregariously on the broad sandy belt on the Atlantic Coast from near La Rochelle in the north to Bayonne in the south (a total length of about 200 miles), and again on the Mediterranean coast up to the vicinity of Cannes; but in this latter region it does not seem to secrete enough resin for remunerative tapping.

On the Atlantic coast forests of the pine covered the entire face of the country in the times of the Romans, but were ruthlessly devastated and almost swept away with fire and axe (chiefly the former) on the irruption of the barbarians. The sands, naturally infertile and without cohesion, were laid completely bare, rendering the climate deadly from the malarial emanations from the marshes, which, in the absence of tree vegetation to drain them, formed in all the depressions. The evil was further aggravated by the fine sand, left behind by each receding tide, being piled up by the winds from the ocean into huge hills that ever moved onward, burying everything—trees, houses, villages and even whole towns—in their irresistible advance. A very large extent of the country was thus rendered uncultivable and uninhabitable.

This evil condition of things attracted early the attention of the central government in Paris, but it was not until the reign of Louis XVI that any real attempt was made to remedy it. In view of the magnitude of the evil an engineer of high rank, the Baron de Villiers, invested with independent powers, was sent out to devise and carry out effective measures of restoration and protection. This independence was not palatable to the dignity of the Intendant or local governor, who succeeded by intrigue in obtaining the engineer's recall, but happily not until the latter had completed his enquiries and drawn up his report and plan of operations. The matter was, in any case, far too urgent to be allowed to stand over, and the Intendant secured the nomination of a younger Engineer, the now famous Brémontier, to act under his immediate orders. Brémontier did nothing more than carry out the measures devised by the recalled engineer, and posterity has awarded him laurels which rightfully belong to his predecessor alone.

The measures in question had for their object—(1) the formation and maintenance of a continuous protective dune along the coast, the so-called littoral dune, beyond which fresh sand from the sea would not pass, and (2) the plantation of the entire sandy and malarious wastes behind with the cluster pine, the great industrial and sylvicultural value of which was thus already recognised. The result was an unqualified success. Several thousands of acres of sterile sands have been rendered productive, and a still larger area has been completely reclaimed from marsh and malaria.*

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* I have drunk most excellent *vin ordinaire* produced even immediately behind the littoral Dune; and the establishment of large sanatoria organized by, and under the direction of, the medical profession is the best proof of the present salubrity of the locality.

The early age (about 15 years in private forests) at which tapping can be commenced and the uniformly annual yield of resin thenceforward to be obtained until the death or the removal of the trees has had the effect of making cluster pine woods a most desirable class of property. To this circumstance, combined no doubt with the anxiety to encourage immigration, must be ascribed the unfortunate wholesale alienations of State lands which have resulted in most of the pine forests passing into private hands

The subject of this Report naturally divides itself into four parts as follows:—

1. The treatment and management of the forests,
2. The system of tapping and collection of the resin,
3. Manufacture of the products derived from resin; and
4. Application to India.

I have also added in an appendix a summary account of the manner in which resin is secreted and distributed in conifers, as without a knowledge of the main facts of vegetable anatomy and physiology, so far as they concern the production of resin in trees, it is impossible to devise a rational system of tapping.

I also attach at the end of the Report a printed copy of each of the following —

(1) Conditions imposed by the Ministry in Paris on the sale and lease of resin farms

(2) Additional conditions imposed by the Conservator under the authority of the Director of Forests

I TREATMENT AND MANAGEMENT OF THE FORESTS

The cluster pine not being one of our Indian species, the method of treating forests of it need be sketched out here only in broad outline

Owing to the difficulty and high cost of transport consequent upon the absence of roads, which cannot be constructed on these loose sands except at enormous expense, the wood production of these forests possesses very little value—so little, indeed, that in many places log timber alone is saleable, and were it not for the demand that has recently sprung up for mine props for export to England, such would be the case over the entire area outside the immediate neighbourhood of the railway and of the few existing towns and large villages This being so, the mode of treatment and management is almost entirely subordinated to the production of resin.

The raising of the cluster pine, whether by planting or by direct sowing, on the bare sand presents no difficulty The seed germinates readily, and the young plant is not only hardy and a quick grower, but is even benefited by the heavy ground covering of broom, gorse, heath, or bracken, which comes up in all open places and which it easily pierces through and surmounts

The regeneration of forests of the pine is also a very simple and speedy matter. An entire coupe, or compartment, is clear-felled, oak standards excepted, and the entire undergrowth, whether consisting of mere brushwood or of young pine, pulled up by the roots. Where, however, oak seedlings have put in an appearance, they are preserved, or only cut back if of defective growth. The reasons for getting rid of all the advance growth of the pine is that it has generally been too long under suppression to be of any use. Seeding occurs more or less abundantly every year, so that the coupe is at once sown by the surrounding pine trees. The ground is also soon overrun with the usual covering of bushes, which, without in any way checking the development of the pine seedlings, protects and enriches the soil, and thus renders it more favourable for the forest growth.

The only tree companions of the pine are the common oak and *Quercus Tozza*, which accompany it everywhere, and the cork and occidental oaks, which are confined to specially favourable localities (generally where there is some moisture in the soil throughout the year) in the Department of the Landes. None of the four oaks attain anything like the same stature as the pine, and as they are broad-leaved species with entirely different requirements from the pine, they not only never interfere with, but even very appreciably favour, the growth of this tree both as a timber producer and resin-yielder. A strong admixture of them wherever they can grow would be the most effective means of checking the spread of the root-fungus disease known popularly as "*la maladie du rond*," caused by the *Rhizina undulata* in Sologne and by the *Agaricus melleus* (?) in La Vendée.

As the pine requires no protection against its companion species, no cleanings (*nettoiements*) are called for, but in view of its strongly light demanding character and of enabling the stems to attain early the minimum girth required for the purpose of the resin-tapper, the first thinning is undertaken at the first sign of overcrowding, usually at the age of 10 to 15 years. The after thinning succeeds thinning every five years in State, and every four years in Communal forests. This regular periodicity of 5 and 4 years respectively, is a consequence of the method of tapping adopted, which, as will be seen lower down in Section II, requires that every blaze on trees that are not to fall in the thinning shall be worked for 5 years in State, and for 4 years in Communal forests. The principle observed in the execution of the thinnings is that the crown of the pines left standing shall not touch each other except when tossed by the wind. At or about the age of 60 years there are usually left, in round numbers, only 80 pines to the acre—a circumstance that proves better than anything else the necessity of an undergrowth of oaks to protect the soil.

Private proprietors, always in a hurry to force diametral increment of the stems in order to fit them for tapping as soon as possible, adopt much heavier and therefore fewer thinnings, but this advantage is gained at the expense of height increment and cleanness of bole. Nevertheless, given a sufficient admixture of oaks, heavier thinnings may be justifiable from the moment that the pines have well overtopped their companions, leaving to these the *rôle* of forcing height increment and effecting the natural pruning of the boles. The quantity and quality of the resin will be proportionate to the vigorous development of the crown and freedom of the trunk from branches

The first thinning never yields any saleable produce, and is therefore effected departmentally, often by the guards alone without the aid of daily labour Even the second and sometimes the third thinning may not be remunerative, the stems to fall being too small to possess much, if any, market value, while those that are thick enough to carry a resin blaze are too few and far between to be worked at a profit.

When the stems to fall in a thinning and thick enough for the tapper are sufficiently numerous and close together to yield a remunerative supply of resin, it is evident that it would be a distinct loss not to utilise them before they are felled. Hence such trees, though marked for removal, may be kept standing for the benefit of the resin tapper until 1st April immediately preceding the marking for the next following thinning, *i e*, for a period of 5 years in State forests, and of 4 years in Communal woods. In case, however, of previous death, in order to prevent any accumulation of dead wood, they are at once removed

The State and Communal forests are at present all managed on a rotation of 60 years; but this figure has been adopted only for the current rotation, on the expiry of which, with improved communications established and a more active market secured, it will no doubt be found expedient to raise it considerably. It is, however, never likely to be as high as 100 years, because, owing to the poor soil, the pines enter on their decline before reaching that age

The result of the tapping is, as might be expected from anatomical and physiological considerations, that the whole of the wood in the length of trunk tapped becomes heavily impregnated with resin, and hence acquires an appreciably higher value as timber. Another result, due to the diminution of pressure consequent on the opening of the successive blazes, is enhanced diametral increment over the length of the trunk tapped

II. SYSTEM OF TAPPING AND COLLECTION OF RESIN

The trees are tapped either (i) so lightly as not to interfere with their vegetative vigour (*gemmage à vie*), or (ii) to the maximum extent of which they are capable, even if, as is generally the case, the result is death (*gemmage à mort*) Only those trees which are at once to fall, whether in thinning or regeneration fellings, are treated by the second method, while the first system of tapping is applied to all stems not immediately to be felled, which have a girth of at least 120 centimetres (47¼ inches) in State forests and 110 centimetres (43 inches) in Communal woods Private proprietors, impatient of delay in obtaining a return from their investments, begin tapping *à vie* when the stems are much thinner, often at a girth of only 60 centimetres (23 inches)

In *gemmage à vie* only a single blaze is allowed to be worked, commencing at the foot of the trunk and extending vertically upwards, 65 centimetres (25·6 inches) during the first year, 75 centimetres (29½ inches) during each of the following three years, and 80 centimetres (31 inches) during the fifth year, total length at the end of the five years, 370 centimetres (12 feet 1 inch) At the end of the fifth year the blaze, even if it has actually not been carried up to the maximum height, is abandoned and a new one commenced In Communal woods, however, in deference to the needs of the Commune, which, as a forest proprietor, stands midway between the State and the private individual, and thus partakes of the character of both, each blaze, the total length being still the same, is allowed to be worked in four years as follows :—65 centimetres the first year as in State forests, but 95 centimetres (37·4 inches) during each of the two succeeding years, and 115 centimetres (45¼ inches) during the fourth year In State as in Communal forests the width of a blaze, measured across the wood alone, must not exceed 9 centimetres (3½ inches) during the first three years, or 8 centimetres (3⅛ inches) thereafter As regards the depth of the blaze it must nowhere exceed 1 centimetre (⅜ inch) measured towards the centre of the tree from a cord stretched taut across the blaze from edge to edge of the exposed wood It is obvious that the restrictions with regard to width and depth are extremely difficult to observe rigidly, and hence in practice slight excesses, in the absence of evidence of dishonest intention, are tolerated.

It is the rule to make the successive blazes at the extremities of two diameters crossing each other at right angles, the first two blazes at the extremities of one and the same diameter. The trees being still of small diameter when tapping is commenced, the observance of this rule, besides minimising the risk of harm to their vegetative vigour, secures the symmetrical development of the stem and facilitates its future conversion into scantlings of rectangular section It also gives room for the placing of subsequent blazes It is usual to locate the first four blazes respectively on the eastern, western, northern, and southern faces of the stems, probably for climatic reasons, the danger from exposure to heat being least on the eastern and greatest on the southern side. In any case, the blazes in operation at one and the same time should all look in one and the same direction for convenience both of work and inspection

In *gemmage à mort*, or tapping to the death, on the other hand, the only restriction laid on the tapper is that in making the blazes he shall not cut away anything but such wood as must in any case fall in the subsequent squaring of the stem, in other words, the tapper may place as many blazes as he can on each tree and work them as deep and as wide and as quickly upwards as he pleases, provided that he thereby causes no waste of timber.

The present rotation being one of only 60 years, and *gemmage à vie* being permissible only after a girth of 120 or 110 centimetres, as the case may be, has been reached, no tree can be tapped *à vie* oftener than four times With a longer rotation the trees may attain sufficient size for it to become possible to work two blazes on each stem at the fifth and at each subsequent tapping If such should be the case, the lengthening of the rotation would be a very profitable measure to adopt.

Tapping is never undertaken departmentally, the right of doing so being farmed out for the entire period of 5 or 4 years, as the case may be, required to work a blaze. The farms are sold for a lump sum, to be paid in ten or eight instalments, as the case may be, and the purchaser buys entirely at his own risk, the Department not being responsible either for the quantity or quality of the resin or for loss of trees or resin through accident by fire, weather, etc., or for the number of trees to be tapped *à vie* or *à mort*.

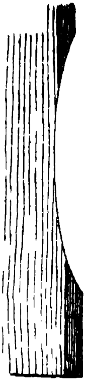
Almost invariably the resin farm and the trees to be felled are put up for sale together, so that the resin-farmer and the purchaser of the trees are one and the same individual.

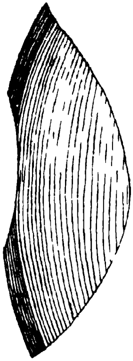
Different marks are stamped at the foot of the tree according as it is to be tapped *à vie* or *à mort*, and in no circumstance may these marks be removed or defaced or even allowed to be covered over by the outflow of resin. Infringement of this condition renders the tree liable to be treated as an unmarked tree and the farmer to be punished criminally as well as condemned to pay damages, in the same way as if he had operated upon an unmarked tree

Tapping is allowed in each year only during the period from 1st March to 15th October (229 days), but preparatory operations, such as shaving off the dead bark over the future blaze, may be commenced from 10th February and the *galipot* (scrapings of dry and thick resin encrusting the blaze) may be taken off until 15th November in the last year of the farm, and until 31st December in all previous years.

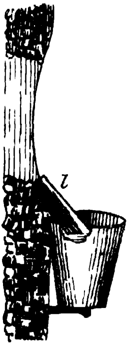
The process of tapping is a very simple one

The dead bark having been previously removed, a blaze is cut right into the wood, about 12 inches high and neither so wide nor so deep as the maximum width and depth allowed. The shape of the blaze on a horizontal as well as a vertical section is a very flat arc (see annexed figure). For the preliminary removal of the dead bark any kind of axe may be used, but for the cutting of the blaze a special tool like an axe, with a curved blade and an extremely sharp cutting edge, called an *abschotte*, is employed.* The blaze is first cut roughly with this tool used as an *axe* or *adze, i.e.*, as a chopping implement, and then the surface is smoothed with the same tool used as a *shave*. In all subsequent operations on the blaze the *abschotte* is used as a shave, so that it is far more a shaving than a chopping tool. It must always be kept very sharp in order to cut clean through the resin ducts in the tree, for a ragged cut would interfere materially with the outflow of resin.


Vertical Section


Horizontal Section

A rectangular piece of sheet iron about 5 inches long and 8 inches wide and bent into an arc is fixed firmly, sloping downwards, into the bottom of the blaze in order to serve as a gutter or lip to collect the resin and let it drip into a baked earthen-pot (in all respects like a small flower-pot without the drain hole), which rests on a nail driven into the tree and is hitched up under the iron lip, so that it can neither fall off nor slip sideways or forward. The annexed sketch, in which *l* represents the iron lip and the front of the pot is shown partially removed away, and the trunk on a level with the blaze is figured in section, illustrates how the pot is fixed. Formerly the pot used to be kept in place by means of a cord tied loosely round the trunk, but the present method is much more expeditious and economical, and is also safer. The capacity of a pot is about $\frac{7}{10}$th pint.



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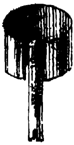
* I do not figure this tool as there are models of it in the Dehra Dun Forest School and in the Jaunsar Division.

If the tree leans strongly to one side and it happens that the blaze has to be made on that side, the pot, even if it could be fixed, would not answer, as most of the resin would drip off the blaze before reaching the lip In that case for the pot is substituted a wide pan (also of baked earth) placed on the ground vertically under the blaze.

Iron pots and pans are never used They are not only very expensive, but, since iron is a good conductor of heat, they heat the resin and thus promote volatilisation and oxidation of the essential oil in the resin. This oxidation also results in a darker colophony. Baked earth, being porous, absorbs rain water and sap moisture from the resin and thus keeps this last always cool Its extreme cheapness is also a great recommendation M. Lesca, the well known resin-distiller of La Teste, condemns very strongly the use of metal in any shape for the collection, transport and storage of resin

After a time the surface of the blaze becomes clogged with thickened resin, which, besides being itself unable to flow, also impedes the exudation of fresh resin The tapper has therefore now to shave off more wood so as to expose again a clean, smooth surface He does this with his *abschotte* as long as the top of the blaze is within his reach directly from the ground, otherwise he uses the tool figured opposite, which has a handle about 6 feet long and, like the *abschotte*, is extremely sharp Formerly he mounted a ladder and continued to use his *abschotte* right on to the end of the last year's operations. The present tool saves him the trouble and fatigue of carrying and mounting the ladder, and also the time required to place the ladder and climb it. The blaze is freshened every 3 to 4 weeks, and each time it is freshened it is also extended upwards. To ensure regularity, the beat assigned to each separate gang of tappers is divided into a certain number of sections which are severally visited in regular rotation.



The emptying of the collecting pots and pans is also effected with the same regularity, whether they are full or not.

The daily collections of resin are at once emptied into wooden casks sunk to the top in the ground and covered first with a board and then with a cowl of thick thatch, the object being to protect the resin as much as possible against heat and volatilisation

The exudations obtained at the successive collections are always stored separately, as the earlier collections not only contain a larger proportion of oil—the most valuable constituent of the resin—but also yield a paler and more transparent, and therefore higher priced, colophony The following figures, very kindly given me by M. Lesca, require no comment —

Resin drawn in	Spring	Yields	21	Per cent of its weight of oil of turpentine
	Summer		19 — 17	
	Autumn		13	

And an inspection of the three cubical samples of colophony submitted with this report and numbered I, II and III, represent, respectively, the three grades according to the season of collection of the crude resin.

The marked disproportion of oil according to the season of tapping is to a great extent explained by Professor Mayr's experiments, recorded in his book referred to in the Appendix Freshly obtained silver fir resin (the richest of all conifer resins in oil), exposed in a shallow vessel in a room, lost—

After	6 hours	exposure	9 6	per cent.	of oil	These percentages have been calculated entirely on the loss of weight due to volatilisation
"	24 "	"	11 3	"	"	
"	2 days	"	11 9	"	"	
"	4 "	"	13 0	"	"	
"	6 "	"	14 0	"		
"	156	"	14 3	"	"	
"	300 "	"	16 6	"	"	

And whereas fresh-drawn resin yielded 63 per cent. of colophony, resin after 300 days' exposure gave 77, or 14 per cent more, the result of oxidation Thus the total loss of volatile matter in 300 days was 14 6 + 14 = 28 6 per cent

Again, fresh spruce resin yielded 75 per cent colophony, after 50 days' exposure the percentage rose to 87, and after 189 days to 93.

Lastly whereas fresh Scots' pine resin contained 62 per cent colophony, after 100 days' exposure the quantity increased to 71 per cent. Fresh resin exposed for 24 hours suffered a loss of weight by volatilisation of 14 9 of oil, and the loss in 100 days was 27 1 per cent. Thus the total loss of oil was 9 + 27 1 = 36 1 per cent

All Professor Mayr's experiments were tried with resin free from impurities

Comparing the conditions under which these experiments were carried out with those obtaining outside in the forest on a blaze, in the one we have the still air and cool atmosphere of a room, whereas in the other we have air in constant active circulation (even strong wind) and warmed up by the sun during the day and by reflected heat during the night More than this In the experiment the resin was undisturbed, on the blaze it is in constant movement The conclusion is therefore obvious that both volatilisation and oxidation are greater on the blaze than it was in the experiment room

It is now clear why the yield of oil diminishes and the colophony gets darker with the advancing season In spring not only is the outflow of resin fastest, but the air is coolest and stillest As the season advances the resin exudes and trickles down the blaze more and more slowly, the temperature of the air steadily rises, winds become stronger, and the length of blaze operated upon, *i e*, the surface of exposure of the resin, increases It would be interesting to ascertain by careful experiment whether the fresh-oozing resin, according as it is [illegible] in spring, summer or autumn, would yield diverse results.

Two facts observed in the cluster pine forests are worthy of note by the Indian forester One is that there is no outflow of resin during winter, and the other is that the portion of the blaze worked during the preceding year yields no longer any resin. This is contrary to our experience with the *Pinus longifolia*, a blaze in which runs with resin not only also during winter, but for at least two years after it has been opened.

The annual yield of the *Pinus pinaster* per blaze is, according to the soil and locality, from 2 to 2·7, average 2·3 kilogs. (4·4, 5·9, 5lb.) of liquid resin and about 0·35 kilog. (¾lb) of *galipot*. Thus in a forest in full production, containing on an average 80 trees from 50 to 80 years old per acre, all tapped *à vie*, the annual yield would consist of 460 kilogs. of liquid resin and 70 kilogs of *galipot*, which, even at the present low prices, would produce a net annual income of 25*s*. per acre. Against this must, of course, be counted the first period of 30 years without any revenue at all, and a comparatively small return from the few trees fit to be tapped during the next 20 years. But, *per contra*, the revenue from resin during the five years preceding the clear regeneration felling, when the trunks of the trees are covered with as many blazes as they can carry, becomes nearly quadrupled, and the ligneous produce of the later thinnings and of the final clear-felling constitute a far from negligeable quantity, even in the present absence of good export roads.

The price of the crude resin delivered at the distilleries fluctuate with the prices of the manufactured products in the Bordeaux market, and of late years, owing to the American competition, it has been falling terribly. This year the ruling prices per *Gironde barrique* (235 litres = 52 gallons) have been as follow :—

For resin collected.	up to end of April	47 francs	(=9*d*. per gallon.)
	,, ,, May	37 ,,	(=7*d*. ,,)
	from June to August	32—35 ,,	(=6—6½*d*. ,,)
	after August	25—30 ,,	(=5—5½*d*. ,,)

In the Department of the Landes the barrique contains 340 litres (75 gallons). There the May collection realised 61frs. per barrique, or 8*d*. a gallon, and 35 frs., or 4½*d*. a gallon.

The *métayer* system prevails to a great extent between landlord and tenant in the part of France in question, and this system has been adopted also in the resin-tapping business, so that the tapper receives half the money-value of the resin he collects.

Through the kindness of M. Muel, Conservator of Forests at Bordeaux, I am enabled to give the mean net revenue per acre obtained by the State from its resin farms alone. From the beginning of tapping (average age 35 years) up to the age of 55 years 10 shillings per acre per annum; during last five years of rotation, 39 shillings; for entire rotation, 4 shillings per acre per annum.

The system of tapping described in the preceding lines is the outcome of more than half a century of practice, during which period many improvements have been devised and adopted. But there is still plenty of room for more, seeing that the difference in the quality of the different seasons' collections is so very great, and that the average amount of impurities in the resin delivered at the factories runs up to as much as 20 per cent.

III. DISTILLATION OF ESSENTIAL OIL OF TURPENTINE AND MANUFACTURE OF COLOPHONY.

I had the good fortune to be able to visit two factories where these products are manufactured according to essentially different methods, *viz.*, that of the old-established house of Messrs Lesca et fils at La Teste on the Arcachon Branch Railway, 35 miles south-west of Bordeaux, and fitted up with old-style apparatus, and that at Hardy-Soustons, on the St Vincent-Soustons Branch Railway 21 miles south-west of Dax and 98 miles south-west of Bordeaux, and belonging to the "La Térébenthine Française," a joint-stock company started only two years ago with a capital of 1 000,000 frs (₤40,000), and possessing seven other similar establishments, all furnished with appliances of the most recent type

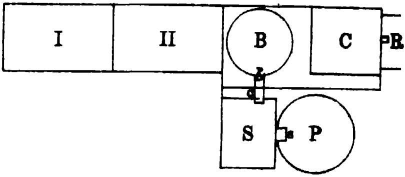
Messrs Hearle and Moir have already published descriptions of the system of manufacture followed at La Teste, but as my information, which I obtained directly from M. Lesca while the factory was in full operation, is more complete, and I must compare his methods with those of the "La Térebenthine Française," I may be pardoned for giving here my own account of them, which, it will be seen, differs in some important respects from what Messrs. Hearle and Moir have said.

1 The Lesca System

The apparatus employed in distilling consists of—

1° An open iron vat divided by a partition into two compartments (I and II in subjoined figure) and heated from below by a fire in direct contact, so regulated as to be just hot enough to liquefy the resin without producing ebullition This is rather a primitive contrivance, and actually the fire often gets out of control, being either too quick or too slow

2° A still consisting of the usual three parts—boiler, condenser and receiver (B, C, R in figure) The boiler, which is double-walled and takes a maximum charge of 245 litres (=54 gallons), is heated by direct contact with water contained inside the outer jacket and kept up at the required temperature by passing steam through it at a pressure varying from 8 to 5 kilogs. per square centimetre (20 to 32 lb per square inch). It is fitted with a thermometer. In the bottom of the boiler, in front, is a hole of about 8 inches diameter, which, during distillation, is stopped with a wooden plug (p) wrapped round with cloth and well luted When the plug is removed the liquid colophony runs out through the short canal (c) into the straining box S The receiver is fitted with two outflow pipes, one on a level with its bottom for the escape of the water that distils over



with the oil, the other just below its top for the passing out of the oil by overflow. Both pipes are provided with stop-cocks. The boiler and condenser, as well as the vat previously described, are raised about three feet above the floor of the factory.

3° A straining box (S) with the bottom sloping in the direction of P and heated by direct contact with water below. A moveable sieve with very fine meshes is placed on the top, and at the bottom, on the right, is an opening fitted with a long shoot (S), which overhangs the pan P. The straining box is constantly maintained at a very high temperature in order to keep the colophony passing through it as fluid as possible.

4° A large iron pan (P) sunk in the floor and, like the straining box, constantly heated in direct contact with water below.

In an adjoining room is a boiler which supplies steam to the water-pumps and for the purposes of the distillation.

The process of manufacture is as follows: The crude resin, in the condition in which it comes from the tapper, is emptied into I. When sufficiently liquefied, it is ladled over a bed of loose straw, which effectually arrests all impurities, so that it passes through into II thoroughly filtered. From II it is pumped up into the boiler of the still. To promote the easy and rapid disengagement of the oil from the colophony, a thin stream of hot water is allowed to flow constantly into the boiler during the distillation. The essential oil, intimately mixed with steam, distils over through the condenser into the receiver, from which the water escapes away through the pipe in the bottom, while the oil passes out by overflow through the upper pipe and is carried away in buckets to a large metal tank situated in the open at a sufficient distance from the factory to be out of the reach of accident by fire.

The distillate, as it runs out of the condenser, is examined from time to time towards the close of the operation for the proportion of oil it contains. As soon as the proportion becomes insignificant, the thin stream of water that is allowed to flow into the boiler is shut off. With the diminishing quantity of water inside the boiler, the temperature rapidly rises. Experiment has demonstrated, according to M. Lesca, that the last trace of water has disappeared when the indicating thermometer touches 145° C. As soon as this point is reached, the plug (p) is removed and the residue in the still, now no longer containing either oil or water, is allowed to run on to the sieve placed upon the straining box. This sieve arrests all the dark, almost black, tarry and pitchy substances that form in the colophony, owing to the very high temperature to which it is subjected. To secure perfect filtration, the colophony is passed through a second sieve placed upon the sunken pan (p). What remains on the first sieve is only suited for the manufacture of tar, pitch and lampblack; what remains on the second sieve is collected, and when there is a sufficient quantity of it, it is passed again through the boiler, but this reheating darkens the colophony very appreciably.

From the charging of the boiler to the removal of the plug to let out the colophony an interval of only 15 minutes more or less elapses, so that the boiler is charged three to four times in an hour.

Attention has been already drawn to the remarkable fact that reheating colophony that has cooled tends to darken it To this cause must be attributed another equally remarkable fact. The colophony derived from the first distillation every morning is always darker coloured than that resulting from the subsequent distillations, the colophony adhering to, and hardening on, the sides and bottom of the boiler after the last distillation of the previous day being responsible for this effect.

The colophony in the pan (P) is at once ladled out into buckets and poured into flat iron pans about 20 inches in diameter and 3 inches deep, with almost vertical sides and a perfectly flat bottom. In order to accelerate cooling, the pans are supported across wooden battens laid parallel to one another on the floor. The colophony becomes fairly hard in less than three hours, and when the pans are cool enough to be handled, they are taken away into the large open yard outside, where they are kept for two weeks and even longer to bleach under exposure to sun and atmospheric influences In this manner the colophony becomes many shades lighter This bleaching process, although no doubt it raises very considerably the price of the produce, is a troublesome and expensive process It demands thousands of pans, a very large area to operate in, the immense labour of filling each pan and carrying it outside an average distance of 50 yards and then carrying it away into the sorting shed, the removal of the cakes from the pans and their careful deposition on the floor of the sorting shed the tedious process of sorting according to colour and clearness and of packing, and finally the long period of waiting from the time the colophony is run out of the still boiler to the time it is ready for export As the colophony in cooling and contracting becomes full of deep cracks, the cakes, after removal from the pans, require very gentle handling

The cakes are packed in small deal-wood barrels of the same interior diameter as the cakes The packers have to be extremely careful to put into a barrel only slabs of one and the same quality of colour and clearness, as the price of the entire contents is fixed by the worst quality of slab found inside it On the very first warm day after packing, the slabs unite into a single solid mass

In spite of every care some cakes get broken or are too defective in quality to be classed and packed These have to be remelted, with the inevitable result of a deeper coloration. Hence the great importance of conducting the manufacture with good apparatus and, above all, experienced and conscientious workmen In order to control effectively the work of each day, round sample slabs about 2 inches in diameter and ½ inch thick are taken from the colophony obtained from each distillation These slabs are closely examined the same day by the proprietor or his representative, and small cubes cut from them are marked with the date and kept in a cupboard, arranged according to dates.

M. Lesca pays special attention to the coloration and transparency of his colophonies, and justly prides himself on the high quality of his manufactures. The little cubes numbered I, II and III which accompany this Report and which represent the products obtained, respectively, from the spring, summer and autumn tappings, are also samples of his best, average and worst qualities (that obtained from galipot being excepted) The palest represents the quality known in the English market as *window glass.* The relative values of the three types will be gathered from the present ruling prices which are, respectively, 42, 32, and 21 francs per 100 kilogs. (roughly 17½, 13½ and 8¾ shillings per cwt)

Now M. Lesca's figures quoted higher up on page 32 show that

resin	spring	yields	21	per cent	59	per cent colophony.
drawn	summer		18	essential	62	
in	autumn		13	oil and	67	

Hence a single charge of the boiler (approximately 5 cwts) yields, according to the class of resin used, respectively 325, 341 and 369lb, worth, respectively, 52, 41 and 29 shillings Thus the loss on each charge (and there are several thousands a year) would be—

11*s* .	if	average	grade of colophony	highest	grade
23*s*. .	only	lowest	were obtained from resin	highest	
11*s*	the	lowest	capable of giving the	average	

The preceding figures have, for the sake of simplicity, been calculated on the assumption that the prices of all classes of crude resin are identical (if the true prices were taken the corresponding figures would be from 20 to 40 per cent higher, but in that case allowance would have had to be made for the larger yield of oil) We thus see how amply justified M. Lesca is in laying so much stress, not only on obtaining pale and clear colophony direct from the still, but also on the bleaching of the cakes, notwithstanding all the trouble and waiting involved. Moreover he manufactures specially for the English market which requires the pale sorts

2 *The "La Terébenthine Française" System*

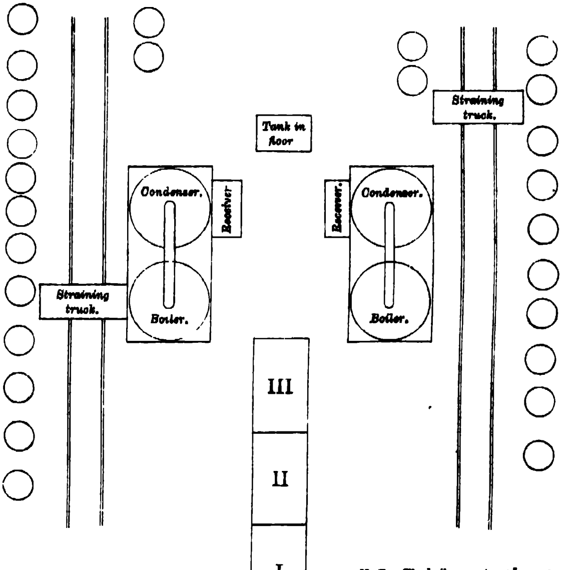
Each of the eight factories consists, exclusive of office buildings, store-rooms and dwellings, of two sheds situated about 80 feet apart. One of the sheds, by far the smaller, contains a boiler by Babcock and Wilcox of London and Glasgow, which generates steam for the entire establishment, and a pump for raising water It is in this shed alone that any fire can be lit, hence its isolation for security against accidents.

In the other shed are carried on all the processes of distillation and straining and packing of the colophony. The apparatus (inventor

Germont; patentees: The Company itself; makers: Dyle, Bacalan et Cie. of Bordeaux) consists of—

1. A long rectangular iron trough divided by very fine wire gauze partitions into three compartments and heated from below with steam. The crude resin, as received from the forest, is put into compartment I, from whence, when liquefied, it passes successively into compartments II and III, being thus filtered twice over. From III it can at pleasure be forced up by pneumatic pressure into the exhausted boiler of either of the two stills.

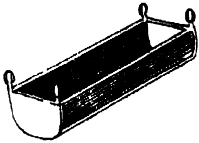
2. Two stills, consisting each of a boiler fitted with a steam jacket, a condensor and a receiver, from the last of which the water that comes over with the oil is drawn by a pipe in the bottom, while the oil passes over, through an overflow pipe, into a small tank in the floor. As the tank fills it is emptied by means of a forcing pump worked by steam into a large raised iron tank situated outside about 100 feet from the shed. The charge of each boiler is 500 kilogs. (1,100 lb) of crude resin. Contrary to the Lesca system, no water is used in mixture with the resin during the distillation to help the disengagement of oil. Indeed such mixture is considered not only superfluous but a decided



N. B.—The boilers and condensers are on plat-forms higher than the top of the straining truck.

disadvantage, as the water has ultimately to be driven out of the colophony. The boiler is heated with superheated steam, which is maintained at a temperature of 110° C during the distillation, and, when oil ceases to pass over is raised to 164° C. in order to expel the last trace of water from the colophony.

3 Two rectangular iron troughs (one for each still) mounted on wheels running on rails and of a capacity of about 100 gallons. On each trough across its entire length, rests a more or less semi-cylindrical sieve of wire-gauze stretched on a strong iron frame The meshes are extremely small, being 260 to the square centimetre or 1,680 to the square inch. The object of the curved section of the sieve (see annexed sketch) is to enable it to be rocked slowly from side to side in order to quicken the passage of the colophony through the meshes When the boiler is ready to be emptied, the trough is wheeled up to it to receive the colophony Empty wooden barrels always stand on each side of the rails, and the colophony is poured into them immediately after it has been strained The colophony hardens in a few hours, and as soon as it is cool the barrels are closed and ready to be exported There is no bleaching process at all, and crude resin received one day is in a condition to be exported the very next day in its manufactured forms



The boilers are charged 20 times a day, yielding, the two together, at each operation, 200 kilogs, (440 lb of) oil and 640 kilogs (1 408lb) of colophony (a little more than 14 per cent of the charge disappears, as water or remains behind in the sieve as residue) Thus the daily outturn is 8,800lb of oil and 28 160lb of colophony

The oil sells at the factory at 70 fr per 100 kilogs , or about 30*s* per cwt , and the lowest quality of colophony turned out at 14 fr per 100 kilogs , or 6*s* per cwt

The Company has hitherto paid little attention to the colour of its colophony, their lightest coloured sample being darker than even sample III of M. Lesca's presented with this Report

There is no doubt that if the bleaching process were not omitted, the Company's colophonies would be very much lighter than they are , but it is certain that the darker coloration is to a great extent due to the high temperature (164° C as against 145° C in M Lesca's factory) to which the colophony is exposed for about 5 minutes before the retort is emptied. Questioned by me, the manager said that a lower temperature would not suffice to expel all the water, and that he could turn out a lighter-coloured product if he was willing to allow some of the water to remain. In connection with this statement I may be permitted to give my own experience When I distilled some *Pinus longifolia* resin in 1882, after the oil had passed over, being afraid to burn the contents of the boiler (I had only an ordinary still for preparing distilled water) I turned out the colophony while it still contained a large proportion of water and this colophony was paler than the palest amber , whereas the *Pinus longifolia* colophony now manufactured at the Forest

School with improved appliances is of a very deep brown. In saying this I do not in any way mean to imply that M. Lesca's higher grades of colophony contain any water. Even if they did, the higher prices his pale colophonies command are a complete justification for his not exceeding a temperature of 145° C. At the same time, it must be said for the "*La Térébenthine Française*" Company that, as it works on such an enormous scale, the extra labour, time, plant and space, and therefore expenditure which the addition of the bleaching process would necessitate, would be entirely prohibitive, and the rapid turnover is probably a complete set off against the smaller profits it makes on a given quantity of resin. It is also possible that when its managers and workmen gain more experience (they commenced operations less than two years ago) they may succeed in turning out a higher class of colophony without in any essential manner changing their procedure. Nevertheless, as they manufacture only for home consumption, which wants only the darker sorts, no fault can be found with their system.

In recent years a new industry has sprung up, *viz.*, the manufacture of a pyrogenated oil (*huile de resine*) from which, by treating with alkalis, a lubricant in extensive use is prepared. The cheapest sorts of colophony are subjected to destructive distillation at a very high temperature, the distillate being a thick, heavy oil, the *huile de résine*. There was a factory where this oil was made in the neighbourhood of La Teste, but my engagements, which had been made beforehand in ignorance of the new industry, did not give me time enough to arrange for a visit.

Through the kindness of Mr. William Ward, H. B. M.'s Consul at Bordeaux, I am able to give here some figures relating to exports and prices during 1894.

EXPORTED FROM BORDEAUX.

	Total quantity exported	Kilogrammes, of which to the United Kingdom	
Colophony .	5,735,000	185,000	Kilogrammes.
Essential oil of Turpentine .	1,056,000	86,000	
Resin oil .	865,000	768,000	

In his "Report for the year 1894 on the Trade of the Consular District of Bordeaux," Mr. Ward writes:—

"The production in 1894 of resin was a good average in this district, with a normal export trade in the clearer sorts, the demand being fairly good, but not sufficiently active to cause a rise in prices. The darker sorts were, as in previous years, consumed entirely by French manufactories, and prices for these qualities were well maintained, producers selling at the (for them) remunerative price of 15 to 16 centimes per litre. Business in turpentine for export was slow, as the American essence is always cheaper than the product of this district, and it was accordingly necessary to make a certain abatement in prices in order to facilitate the sale here. The frequent refusal to carry this article by sea on account of its danger likewise contributes towards its exportation being very limited in extent."

IV APPLICATION TO INDIA.

I will begin by describing briefly what appears to me to be the true *rationale* of the process of tapping, based not only on present practice, but also on what is known regarding the anatomy of pine wood and the distribution of resin in it (see Appendix).

In pines we must look for a supply of resin, chiefly to the ducts, horizontal as well as vertical. Now these ducts are so interconnected that, theoretically speaking, if a blaze be opened by the removal of ever so thin a layer of the wood, most of the resin contained in the sapwood (the only storehouse, bast excepted, of fluid and therefore available resin) will gradually pour itself out through the innumerable horizontal ducts out through by the section, as well as through the cut ends of the vertical ducts at the top and bottom of the blaze, for equilibrium of pressure being destroyed by the removal of the bark and wood from over the blaze, and being still further disturbed by the diminished turgescence of the exposed tissues due to loss of the water they originally contained, the greater tension of the tissues behind will cause the fluid resin there to be pressed out in the direction of the least resistance, *i e*, towards the exposed surface and out through the little openings of the cut ducts In this way the resin would continue to pour out until the tissues penetrated by, or in communication with the afferent ducts were exhausted Actually, however, the rate of overflow is so slow and the essential oil in the resin is so volatile, that after a shorter or longer time a film of thickened resin forms over the blaze obstructing the openings of the ducts and preventing what little fluid resin succeeds in escaping out from flowing down to the receiving vessel Hence the necessity of removing not only this very undesirable film, but also a thin layer of the wood, so much of it at least as contains the clogged ends of the afferent ducts But even then the rate of outflow will not be quite so fast as it was originally, since the tissues tapped have already lost a part of their resin and are also less turgescent than before. Hence the only way to restore the first rapidity of outflow is to lengthen the blaze and lay under contribution fresh tissue Thus far we have seen that *to tap a tree we must first make a blaze by removing a very thin layer of the sapwood, and then from time to time take off a thin shaving so as to expose a fresh surface and at the same time lengthen the blaze.*

The point to consider next is *whether to extend it in one direction alone or both upwards and downwards* The present practice is to extend it only upwards The only reason that I see for this practice is that it is always to the tapper's convenience to begin the blaze at the lowest point, only upward extension is then possible, and the practice having thus originated, has been kept up because the part of the tree richest in resin is the region of the root-collum. But it finds no justification in the facts of vegetable physiology.

In every blaze the most abundant exudations occur at the top and bottom, for whereas the open mouths of the horizontal ducts are more or less equally distributed over the surface of the blaze, the cut ends of the vertical ducts, always the richest in resin, are situated almost exclusively at the two extremities Hence, when a blaze comes to be freshened, more resin will be obtained if it is extended in both directions than in only one; in the former case new vertical ducts will be tapped at both ends, and so the number of such ducts will be just double what it would be in the other case To meet the possible argument, that extending a blaze upward will draw down more resin, it is only necessary to remind oneself of the fact that resin is formed locally, and does not, like elaborated sap, descend from the top of the tree. Indeed, owing to the greater richness of the lower end of the trunk, the lower end of the blaze, extended both ways, will probably exude more resin than the upper end.

The advantage of extending a blaze both ways is thus established. But in order to be able to extend it thus it must be commenced at a certain height above the ground in other words, exactly in the middle of the length of the trunk which it is ultimately to occupy This procedure will after a little time necessitate the fixing of two receiving vessels, one at the bottom of the blaze the other half way up, or, if resin does not exude from the whole length of the blaze, at the lowest point of the upper outflow. The use of two receiving vessels, far from being a disadvantage, will assure two very great advantages. In the first place the resin will have a shorter distance to travel down the blaze, and will thus suffer less from volatilisation of the oil, and, in the second place, much of the resin which oozes out of the abandoned part of the blaze when the single pot is moved up, and which is now lost, will be utilised

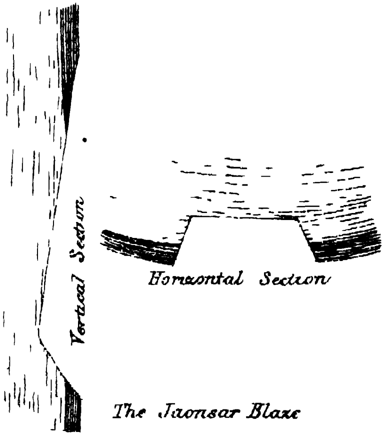
What the total length of the blaze should be must depend on the species of tree, the soil and locality, the length and cleanness of the bole, and the free exposure of the tree to light In practice there must be a limit of height determined by the skill of the tapper, and, if ladders are used, also by his safety.

The final width of the blaze cannot exceed the dimension beyond which the effective direction of the course of the resin into the receiving vessel cannot be easily controlled If the tree is young, its thickness will also be a determining factor What the initial width should be is easily calculated At each freshening of the blaze its width will necessarily be increased by twice the thickness of the wood shaved off. Hence, if t = this thickness, n = the number of times the blaze has to be freshened, w = the initial width, and W = the final width—

$$w = W - 2nt.$$

I will now proceed to offer a few remarks directly referring to India. The only part of the country in which the resin industry is being prosecuted, is the School Circle of the North-Western Provinces It is now nearly five years since I left that Circle, and in the interval many changes in both tapping and manufacture have no doubt been introduced, of which I am of course not cognisant Hence in the remarks which follow and which refer to the work there, I must be pardoned if I speak only on the basis of my knowledge of things as they were then.

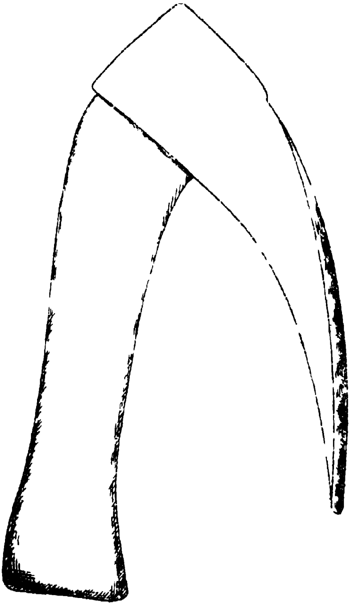
The first and most urgent improvement to introduce is the adoption of a better form of blaze. The present one (annexed Fig.) offends against all the facts of anatomy and physiology. Its worst features are—(1) that the initial depth is far too great; (2) that the cross-section is such that it renders impossible a rational system of gradual shaving in freshening the blaze; and (3) that it profits as little as possible, by the existence of horizontal ducts, those innumerable little mouths through which thousands of longitudinal ducts yield up their resin without requiring to be cut or exposed. But so long as the wretched little hill adze is used, no improvement is possible. The Jaonsári tappers were supplied with an *abschotte* of the French model, but not knowing how to use it, they at once rejected it on the ground that it was too heavy. And yet the same men do not mind wielding felling axes almost as heavy, although the weight being the same, felling axes require much more expenditure of power than a tool which, like the *abschotte*, on the rare occasions when it is employed as a chopping implement, is not only moved up and down vertically, *i.e.*, in the direction of its own weight, but is used for dealing light strokes! The rejection of the *abschotte* is thus entirely based on a complete misconception of its purpose and mode of employment. As I have shown in Section II, it is essentially a shave, and only secondarily an axe. Being a shave, it is kept extremely sharp, the edge being so fine that violent blows with the tool would break it. With it the tapper takes off, with a single push or draw, long shavings hardly thicker than an ordinary postcard. When the blaze is too high to be reached with the *abschotte* from the ground, the tool figured on page 32 above is substituted, the shave character of which admits of no doubt. If the French *abschotte* is really too heavy for the Jaonsári and Garhwáli workmen, nothing would be easier than to construct a lighter model, possessing, however, the same width of cutting edge. Or if they are so wedded to the adze form as to be unable to adopt the *abschotte*, for their very rude adze may be substituted the tool (figured on the next page) which is one amongst many used in Austria in tapping the black pine, and can be employed both as a shave and an adze.

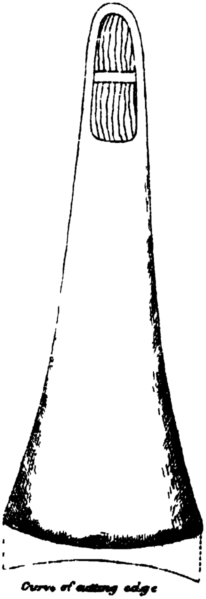


The Jaonsar Blaze

The necessity of using two, and sometimes even three, receiving pots when the blaze has been extended over a great length, should not be forgotten. Also some arrangement should be made to prevent the exudations during winter being lost by overflow on to the soil.

When I last visited Jaonsár (1890) the resin collections were kept, until carried away to Dehra Dun, in old kerosene oil tins, either in similar open tins or in troughs resembling dug-out canoes, placed on the bare soil under the trees, and nothing was done to prevent leaves, twigs and dust from falling into the resin. There was also unchecked exposure to the deteriorating influences of sun and air. Moreover, no attempt was made to distinguish the exudations of the different seasons either during collection and storing or distillation.





At present the distillation works are at Dehra Dun, but now that the period of experiment is over and considerable experience has been acquired and a market created, all the processes of manufacture should be carried on in the immediate neighbourhood of the forest Saving in cost of transport and fuel (which latter has no market value at all where the pines are tapped) would constitute an important item and more than double present profits It is also time now to extend operations and organise the industry on a large and permanent scale The fir timber which has now, from absence of a demand, to be killed and allowed to rot in the forest, could then be utilised for making packing cases and barrels for the export of the colophony.

The officers of the Forest School and of the School Circle have proved that the resin industry can be made a paying one even in the remote, bleak, inhospitable and almost inaccessible forests of Jaonsar It therefore behoves the department to start similar operations in the numerous far more favourably situated forests of the Central Circle in the North-Western Provinces and of the Punjab.

I know too little of the forests of the Punjab to offer any suggestions, but it is otherwise with the forests of Naini Tal and Ranikhet, which between them contain at least 100 square miles under *Pinus longifolia*, growing on low hills and on dry soils, both circumstances favourable for the production of resin The Naini Tál area lies practically on the railway itself, while the Ranikhet blocks are tapped by cart roads which connect them with the same railway about 40 miles off. In both places labour is more easily procurable and cheaper than in Jaonsár, and the climate is so mild that the forests are open all the the year round. With work in full swing there would be annually not less than 3,000,000 blazes in operation, yielding roughly 20,000,000℔ of crude resin, which would furnish more than 300,000 gallons of oil of turpentine and 5,000 tons of colophony, thereby not only returning a handsome revenue to the State, but also contributing powerfully to the well-being of the hill inhabitants

Strange as it may seem, the very first systematic attempt made by the Department to utilise its resin resources was tried at Naini Tál in 1882, when a number of trees were tapped, and I distilled a small quantity of oil and made some resin as samples for essay in the market. It is a pity the experiments were not continued, as no forests in the whole of the empire offered a more promising field for the enterprise.

In conclusion, I would advocate the organisation of systematic enquiry by the staff of the Dehra Dun Forest School to ascertain for all our resin-yielding species, coniferous as well as broad-leaved, the following points —

(1) Yield of resin on different soils and localities and under different degrees of isolation of the tree.

(2) Yield at different ages.

(3) Yield at different levels of the trunk.

(4) Yield at different seasons.

(5) Proportion in all the four preceding cases of oil, colophony and water.

(6) Rate of volatilisation of the oil from crude resin under circumstances similar to those prevailing on a blaze.

(7) Increase of the proportion of colophony by oxidation.

(8) Quantity of non-fluid resin in the different parts of the trunk.

Experiments should also be made to devise some more or less effective method of diminishing the great loss of oil which takes place through volatilisation on the blaze.

Lastly, if an Instructor possessing the necessary skill can be found, time should be made for him to prosecute an anatomical and physiological study of each species.

With improved methods and organisation, there is every probability of our competing successfully with the American and European products in the markets of Europe.

APPENDIX I.

As some exact idea of the manner in which resin is secreted and distributed in conifers is necessary for a correct understanding of the *rationale* of tapping, I give here, with the full permission of the obliging author, a few notes taken from my friend, Professor Mayr's excellent Monograph* on the constitution, distribution, significance and utilisation of the resins of conifers, to which book the reader is referred for further information.

Resin is a by-product formed during the constitution of coniferin from starch, which is the sole source also of resin In no circumstances can any other substance, such as coniferin, lignin or cellulose, pass into resin. Resin is formed from starch locally, and does not descend with the elaborated sap It is never met with outside special receptacles which are—

1. *The ends of the hairs on very young shoots of some species* —The resin is secreted at the extreme end of the hair between the cuticle and the terminal cell This source of resin has no importance at all for the tapper.

2 *All the parenchyma cells of the wood and all the transverse parenchyma cells in the bark.*—These cells secrete resin inside themselves, and in the case of species which contain no resin ducts, such as silver fir and Tsuga, they are the only source of resin In the wood these cells are found mostly in the medullary rays, being met with elsewhere only in the medullary sheath and in immediate contact with the resin ducts of healing tissues developed over wounds and diseased parts In species which contain no resin ducts, they also constitute the last row of cells of the several concentric rings of wood. In the bark resin cells are found in the phelloderm, and they constitute the hypoderma in pine needles and the guard cells of the stomata. The resin in the cells of the sapwood is entirely fluid, and goes on increasing in quantity right up to the period of change into heartwood, after which there is not only no further increase, but a part of the resin present becomes hard and ceases to become available for the tapper. Another fact to be noticed in connection with the change into heartwood, is that the thin-walled resin cells in contact with the resin ducts swell up bladder-like and, meeting across the lumina of the ducts, stop them up completely In their ordinary condition the resin-cells are extremely small, their extension varying from 3 to 8 millionths of a square inch Whereas in the silver fir all the cells of the medullary rays are parenchymatous and therefore resin-bearing, in the spruce the proportion of such cells is only 77 3 per cent (the rest being tracheides), and in the Scots' pine 40 7 per cent in a severe climate and 44 4 in a mild situation on low hills In the pine the cells are more numerous towards the interior of each annual ring, more

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* "*Das Harz der Nadelholzer, seine Entstehung, Vertheilung, Bedeutung und Gewinnung*" Dr Heinrich Mayr, *Ord Professor an der Kgl Universitat, Munchen* Julius Springer, Berlin, 1894—96 pp and 10 Illustrations. Price 3 Marks

numerous on the south than on the north side of the trunk, and more numerous with increasing nourishment and illumination. Resin cells are not a very prolific source of supply.

3 *Resin ducts or spaces*—These are the most important of all receptacles for the industry. Their constitution is exclusively intercellular. As a result of irregular tensions in the tissues during growth, and as a direct consequence of growth, two neighbouring cells separate from one another and thus form an intercellular space If the separation extends successively along a line of connected cells, a duct or canal is formed. Now, if the separating cells happen to be resin cells, the corresponding ducts and spaces formed become resin ducts and resin spaces, for the balsam from the cells passes out through the walls into the intercellular lumina and gradually fills them up An outer system of such ducts permeates the needles and the limitary tissues of young shoots, but has no interest for the tapper, who is concerned only with the inner system, *viz*, that which runs only through the wood and bast. This inner system consists (1) of a vertical system, the ducts running along the length of the stem and being confined exclusively to the wood, and (2) of a horizontal system, composed of ducts which, taking their rise from the vertical ones run out horizontally, through and with the medullary rays, right into the bast, where they terminate. Once the current year's growth is over, no more new ducts can be formed, nor can any further extension of existing ducts either in length or bore occur In *Picea* and *Larix* some of the cells enclosing the ducts become from year to year thick-walled and then they fulfil during the entire sapwood period the same function as medullary rays. In the Genus *Pinus*, on the contrary, all the cells enclosing the ducts remain during the entire period thin-walled and continue to contain protoplasm, resin and starch, though in some of them tannin takes the place of the resin, which then entirely disappears. Before the sapwood passes over into heartwood (from 8 to 15 years after its formation) the thin-walled cells increase in size, and, as already said above, swell up like bladders, meeting and filling up all the space in the ducts not occupied by the resin, which thereupon loses its fluidity and becomes completely stationary, neither the force of gravity nor difference of pressure being able to move it. The vertical ducts are from 6 to 12 inches long in the larch, and from 16 to 27½ inches long in the spruce They are shortest in the vicinity of branches and longest at the foot of the tree Although they always run along the length of the axis, they are never straight, but curve outwards so that their extremities lie near the outer edge of the annual ring without, however, ever passing into the next ring Two vertical ducts may unite by anastomosis, in which case, instead of there being tracheides between them, as would happen if they were not united, the intervening space is occupied by parenchymatous cells which, separating from one another, form passages of intercommunication between the united ducts. The number of vertical ducts counted on cross sections of the stem of a spruce 100 years old was 40,000 to 50,000 per square inch, the number decreasing steadily from below upwards. The ducts in the genus pine are from 20 to 70 per cent wider than in the spruce

All trees that possess vertical ducts, possess also horizontal ones. In a spruce stem the average number of horizontal ducts given out by an inch length of vertical duct is about 3, but in a very vigorous tree the number may run up to as many as 17 When the parent vertical duct passes into the heartwood stage, the daughter horizontal ducts are cut off from all communication with the vertical system, unless in their course towards the bark they meet and unite either directly or through the medium of a new intercellular space produced in the intervening thin-walled parenchyma, with other younger vertical ducts. During vegetative rest in winter the ends of the horizontal ducts are closed at the outer edge of the sapwood by the cambium ring, which has, of course, no intercellular spaces. The bore of the horizontal ducts is about half that of the vertical ones The average number of horizontal ducts on 1 square inch of tangential section is, in spruce, 41,000, in Scots' pine, 40,000 In all other respects what has been said regarding vertical ducts is true also of horizontal ones.

4 *Resin Galls*—In consequence of differences of pressure resin often escapes out of the sapwood tissues into the cambium, which at once isolates the effusion by surrounding it with tissues similar to that formed on wounds Resin galls have obviously no interest industrially.

5 *Effusions of resin in internal cracks in the wood*—These too, like resin galls, have a pathological origin and possess no interest for the tapper

To resume what precedes, we have seen—

(I) That resin is formed directly from starch, and is not a product due to the degradation of cellulose or lignin or coniferin,

(II) that it is formed locally, simultaneously with coniferin, and does not come down or wander about with the elaborated sap,

(III) that it is met with only in special receptacles, of which first and foremost, ducts (both vertical and horizontal) and next, but *longo intervallo*, resin cells have alone any practical interest for the tapper,

(IV) that these three classes of receptacles are distributed all through the wood in such enormous numbers that the removal of the thinnest possible shaving exposes new ones,

(V) that on the sapwood passing into heartwood, the contained resin loses its fluidity, and not only this, but

(VI) that the ducts, hitherto open in every direction, become completely stopped up by thylose (swelling out of the enclosing thin-walled cells), and

(VII) that consequently it is waste of labour and irretrievable injury to timber to attempt to draw resin from the heartwood.

To these seven apothegms which no educated resin-tapper should forget, may be added the nine following:—

(*a*) The quantity of resin is largest in the region of the root-collum, next in the clean part of the bole, and least in the vicinity of the branches;

(*b*) more resin is secreted on the south than on the north side of a stem;

(*c*) more in a warm than in a cold climate;

(*d*) more on a warm than on a cool aspect;

(*e*) more on dry, and therefore warm, soils than in moist places;

(*f*) more in open than in crowded forest;

(*g*) more on loose, sandy than on stiff and therefore cold soils,

(*h*) more on hilly or sloping than on level ground.

(*i*) moderate tapping promotes diametral increment of the stem and spread of the crown, thereby increasing secretion of resin.

APPENDIX II.

BOIS DE L'ÉTAT,
ÉTABLISSEMENTS PUBLICS

ADJUDICATION DE L'EXTRACTION DES RÉSINES.

CAHIER DES CHARGES.

TITRE 1er.

Des adjudications

Article premier.

La durée des exploitations, celle des gemmages et le nombre des annuités à payer par les adjudicataires seront indiqués par les affiches et reproduits au procès-verbal d'adjudication.

Les arbres à gemmer à mort font partie de la vente à moins d'indication contraire portée à l'affiche et au procès-verbal d'adjudication. Les arbres gemmés à vie ne font pas partie de la vente.

Les pins à gemmer à vie et ceux à gemmer à mort seront désignés dans chaque lot.

Les ventes seront consenties sans aucune garantie de nombre d'arbres, de quantité de résine, de cubage, de contenance, d'âge et de qualité.

Article 2.

Les ventes seront faites par adjudication au rabais en prenant pour base le montant d'une annuité.

Si des lots restent invendus, le président pourra, séance tenante, et sur la proposition de l'agent forestier, procéder à une nouvelle adjudication par lots ou par réunion de lots, et en cas d insuccès, remettre les adjudications à un jour qu'il fixera, ou les ajourner indéfiniment.

Le Préfet pourra, d'ailleurs, sur la proposition du conservateur, et après avoir pris l'avis des maires et des administrateurs, autoriser dans les forêts communales et d'établissements publics, l'extraction de la résine par voie de régie, sous la direction d'un entrepreneur responsable, et la vente de gré à gré des matières résineuses.

Article 3.

La vente au rabais aura lieu de la manière suivante

La mise à prix et le taux auquel les rabais devront être arrêtés, seront déterminés par le conservateur ou l'agent forestier qui le remplacera

La mise à prix ennoncée par le crieur sera diminuée successivement, d'après un tarif réglé à l'avance et affiché dans la salle d'adjudication, jusqu'à ce qu'une personne prononce les mots *Je prends*.

L'adjudication sera tranchée au taux du rabais dont le crieur aura énoncé ou commencé à énoncer le chiffre, lorsque les mots *je prends* seront prononcés.

Si plusieurs personnes se portent simultanément adjudicataires, le lot est tiré au sort, à moins que l'un des preneurs ne réclame les enchères Le concours est alors ouvert entre les preneurs

Article 4.

Dans le cas prévu à l'article précédent, l'adjudication aux enchères sera faite après l'extinction de trois bougies allumées successivement Si pendant la durée de ces trois bougies il survient des enchères, l'adjudication ne pourra être prononcée qu'après l'extinction d'un dernier feu sans enchères survenues pendant sa duree

Les encheres ne pourront être moindres du vingtième de la mise à prix, si elle est de 500 francs et au-dessous, du vingt-cinquième si elle est de 501 francs à 1,000 francs, et du quarantième si elle excède 1,000 francs

Article 5

Le fonctionnaire chargé de présider l'adjudication sera juge de la solvabilité des acquéreurs

En cas de doute, il lui appartiendra d'exiger la présentation immédiate d'une caution et d'un certificateur de caution solvables, ou de remettre l'article en vente, à défaut de garanties suffisantes

Les personnes non domiciliées en France qui voudront prendre part aux adjudications devront, avant la séance, justifier de leur solvabilité, pour les bois de l'État auprès du receveur des domaines chargé d'encaisser les prix de la vente, et pour les bois des communes et des etablissements publics auprès des maires et des receveurs des communes, et des administrateurs et receveurs des établissements publics

Article 6

La déclaration de command ne pourra être faite que séance tenante

Si le command a les qualités requises pour être admis, et si son mandat est présenté immédiatement, l'acceptation du command ne sera pas nécessaire, mais si ce dernier n'a pas donné de mandat, il sera tenu d'accepter par le procès-verbal même d'adjudication, et séance tenante

La déclaration de command et l'acceptation étant insérées dans le procès-verbal, ne donneront lieu à aucun droit particulier

Article 7.

Les minutes des procès-verbaux d'adjudication seront rédigées sur papier visé pour timbre, et signées sur-le-champ par tous les tionnaires présents et par les adjudicataires ou leurs fondés de pouvoirs et dans le cas d'absence, ou s'ils ne veulent ou ne peuvent signer, il en sera fait mention au procès verbal

Article 8.

Chaque adjudicataire sera tenu, sous les peines portées par l'article 24 du Code forestier, de donner, dans les cinq jours qui suivront celui de l'adjudication, une caution et un certificateur de caution reconnus solvables, lesquels s'obligeront solidairement avec lui à toutes les charges et conditions de l'adjudication, et seront notamment soumis comme lui à l'obligation d'élire domicile au lieu d'adjudication, à defaut de quoi tous actes postérieurs leur seront valablement signifies au secrétariat de la sous-préfecture (article 27 du Code forestier)

L'adjudicataire sera, dans le cas de déchéance, tenu de payer, s'il s'agit de bois de l'État les frais de la premiere adjudication, à raison de 1 60 pour cent, du montant de l'adjudication ,[1] et s'il s'agit de bois de communes ou d établissements publics, lesdits frais d après le chiffre qui aura été arrêté par le president de la vente

Article 9.

Les cautions et certificateurs de cautions seront reçus du consentement du receveur des domaines pour les bois de l'E'tat, et pour les bois des communes et établissements publics du consentement des maires et des receveurs de ces communes, et des administrateurs et receveurs des établissements publics

Les actes y relatifs seront passés au secrétariat du lieu de la vente, et à la suite du procès-verbal d'adjudication.

TITRE II

Prix des adjudications

Article 10.

Outre le prix principal de l'adjudication, il sera payé

Par les adjudicataires, dans les bois de l'État,

1. 60 pour cent du montant de l'adjudication,[2] tant pour les droits fixes de timbre et d'enregistrement des procès-verbaux et actes relatifs a l'adjudication, que pour tous les autres frais ,

Et par les adjudicataires, dans les bois communaux et d'etablissements publics,

Les droits fixes de timbre et d'enregistrement des procès-verbaux et des autres actes relatifs a l'adjudication

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[1] Le montant de l adjudic tion se compose du prix principal, en numéraire des annuités totalisées, augmenté de la valeur des charges (travaux fournitures etc) imposées Toutefois on ne considérera pas comme une charge la valeur sur pied des bois à fournir aux préposés forestiers ou aux établissements communaux

[2] Voir la note 1 sous l article 8

Chaque adjudicataire, dans les bois de l'Etat, des communes et établissements publics, paiera, de plus, le droit fixe afférent au certificat de caution, les droits proportionnels d'enregistrement sur le montant de l'adjudication, augmenté, pour les bois domaniaux, de 1·60 pour cent, et pour les bois des communes et d'établissements publics, des droits fixes de timbre et d'enregistrement des actes antérieurs et postérieurs à l'adjudication.[1]

Article 11.

Les adjudicataires verseront à la caisse du receveur de l'enregistrement et des domaines, immédiatement après la réception des cautions :

Pour les bois domaniaux,

Le 1 60 pour cent, les droits proportionnels d'enregistrement, et le droit fixe afférent au certificat de caution ,

Pour les bois communaux et d'établissements publics,

Les droits fixes et proportionnels de timbre et d'enregistrement.

Article 12.

Les annuités seront versées chaque année, par moitié, les 15 août et 15 décembre, dans la caisse, soit du receveur des domaines, soit du receveur des communes ou des établissements publics propriétaires, suivant la catégorie des bois ; en cas de retard de paiement, les intérêts courront de plein droit sur le pied de 5 pour cent par an, à partir de l'exigibilité des sommes dues.

Article 13

Le parterre des coupes comprenant les lieux de dépôt désignés dans la forêt ne sera point considéré comme le chantier ou le magasin des adjudicataires et les bois qui s'y trouvent déposés pourront, par suite, être retenus en cas de faillite, conformément aux dispositions de l'article 577 du Code de commerce.

TITRE III.

EXPLOITATION, VIDANGE ET RÉCOLEMENT.

Article 14

Le garde-vente que l'adjudicataire doit avoir, conformément à l'article 31 du Code forestier, ne pourra être parent ou allié des préposés chargés de la garde du triage ni des agents de la localité

Il sera tenu de produire à toute réquisition son registre aux agents forestiers, pour être visé et arrêté par eux.

Article 15.

Le permis d'exploiter sera délivré à l'adjudicataire par l'agent forestier, chef de service, sur la présentation des pièces dont le détail suit :

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[1] Ces actes sont le procès verbal de balivage, la citation à récolement, et, s'il y a lieu, le procès verbal d'arpentage.

1° Les certificats constatant qu'il a fait admettre ses cautions et satisfait aux paiements exigés par l'article 10 du présent cahier des charges ;

2° L'acte de prestation de serment du garde vente et le registre dudit garde, pour être coté et paraphé,

3° Son marteau, dont la forme sera triangulaire

L'agent forestier apposera son visa sur les pièces mentionnées aux numéros 1° et 2° ci-dessus.

Il délivrera, en outre, à l'adjudicataire, s'il le demande 1° une expédition du procès-verbal d'adjudication dès qu'elle aura été établie au secrétariat du lieu de la vente, 2° des exemplaires du cahier des charges des clauses spéciales.

Toutes ces pièces seront visées pour timbre (Lettre du Ministre des Finances du 3 mars 1891).

Article 16

L'adjudicataire remettra le permis au chef du cantonnement, et le préviendra du jour où il se proposera de commencer l exploitation

Article 17.

Les quarres et entailles seront conduites conformément aux prescriptions des clauses spéciales, arrêtees par le conservateur et approuvées par le Directeur de l'Administration des Forêts.

Si les arbres à gemmer à mort sont abandonnés aux adjudicataires, ceux-ci pourront les travailler comme ils l'entendront

Dans le cas contraire, les adjudicataires devront les gemmer de manière à ne point leur enlever la valeur qu ils doivent conserver c mme bois d œuvre et de chauffage. Les dimensions des quarres devront être telles que leur ensemble ne dépasse jamais les limites d'un équarrissage régulier.

Article 18.

Tout arbre travaillé contrairement aux principes rappelés en l'article precedent et aux clauses spéciales, sera considéré comme un arbre mutilé, et, dès-lors, l'adjudicataire sera traité comme s'il l'avait abattu par le pied, en conformite des dispositions combinees des articles 192 et 196 du Code forestier

L'adjudicataire sera passible des mêmes peines, toutes les fois que, pour conduire la résine dans le godet, il aura pratiqué au pied des arbres gemmés à vie, des incisions circulaires assez profondes pour attaquer le bois.

Article 19.

L'adjudicataire respectera tous les arbres mis en réserve, quels que soient leur qualification et leur nombre.

Dans aucun cas autre que ceux spécifiés au présent cahier, il ne pourra être abandonné à l'adjudicataire aucun arbre de réserve, quand même il se trouverait un nombre d'arbres délivrés inférieur à celui porté aux procès-verbaux de martelage et d'adjudication. Cette différence ne pourra donner lieu à aucune indemnité en faveur de l'adjudicataire

Article 20

Dans aucun cas, et sous aucun prétexte, les empreintes du marteau de l'État ne pourront être enlevées sur les arbres à gemmer à vie, celles qui existent au pied des arbres à gemmer à mort devront également être respectées, ces empreintes devront rester intactes pendant toute la durée de l'exploitation, et dans ce but toutes les précautions nécessaires devront être prises au moment de l'ouverture des quarres On devra même éviter soigneusement que ces empreintes ne soient obstruées par la résine

Tout arbre sur lequel lesdites empreintes auraient disparu sera considéré comme ne faisant pas partie de la vente, et rendra l'adjudicataire passible de l'application de l'article 196 du Code forestier

Le mode de martelage sera indiqué dans l'affiche et rappelé au procès-verbal d'adjudication

Article 21

Si pour cas imprévus, tel que tracé de laies, garde-feu, travaux d'aménagement, travaux de défenses du littoral, ou pour toute autre cause, des arbres compris dans la vente étaient abattus ou en étaient distraits, il sera procédé de la manière suivante

Une indemnité égale au revenu moyen annuel produit par chaque arbre gemmé à vie sera alloué à l'adjudicataire pour chaque année qui restera à courir

Semblable indemnité lui sera accordée pour les arbres gemmés à mort, mais dans le cas seulement où l'abatage de ces arbres aurait lieu avant la troisième année de l'exploitation

Ces indemnités seront réglées contradictoirement entre le chef du cantonnement et l'adjudicataire ou son facteur, et approuvées par le conservateur

Article 22

Dans le cas où, pendant le cours de l'exploitation, des arbres à gemmer à vie ou des réserves viendraient à être incendiées, à mourir ou à être arrachés et brisés par les vents, ou par toute autre cause étrangère à l'Administration, l'adjudicataire en préviendra l'agent forestier local, afin que la reconnaissance de ces arbres soit faite sans retard

L'adjudicataire devra, sur l'invitation qui lui en sera faite, et dans un délai de quinze jours, abattre ces arbres sauf ceux incendiés, il lui sera facultatif de s'en rendre acquéreur sur procès-verbal d'estimation contradictoire, dont il acquittera les frais et paiera le montant aux caisses qui lui seront indiquées et dans les délais qui seront fixés par cet acte.

Le procès-verbal d'estimation approuvé par le conservateur sera exécutoire sans aucune autre formalité

Aucune indemnité ne sera accordée à l'adjudicataire pour la privation qu'il éprouverait de la jouissance de ceux des arbres destinés à être gemmés à vie

Les arbres gemmés à mort et vendus qui mourront sur pied dans le cours de l'exploitation, devront être abattus immédiatement par l'adjudicataire, et, au plus tard, quinze jours après la mise en demeure qui lui en sera faite par l'agent local

Si les arbres gemmés à mort ne sont pas vendus, il sera procédé, au sujet de ceux qui mourront sur pied pendant le cours de l'exploitation, comme il a été dit précédemment pour les arbres à gemmer à vie et les reserves.

Article 23.

Dans le cas de bris de réserve, par le fait seul de l'exploitation régulièrement conduite, l'adjudicataire sera tenu, envers l'E'tat ou la Commune propriétaire, a une indemnité dont le minimum sera fixe à l'avance pour chaque nature de réserve, et sera consigné dans les clauses spéciales. Cette indemnité sera indépendante du prix de délivrance facultative desdits arbres brises à l'adjudicataire, qui sera tenu en tous cas de les recéper. Cette opération devra être terminée dans le délai de huit jours, a partir de la date du procès-verbal contradictoire, constatant le bris de réserve.

Article 24.

Le service forestier aura la faculté de vendre, sans attendre le récolement de la coupe, les chablis, volis, arbres incendies, morts ou réserves brisées dont l'adjudicataire aurait refusé de se rendre acquéreur dans les conditions spécifiees aux articles 22 et 23, dans ce cas, l'adjudicataire sera tenu de souffrir l'introduction dans sa coupe des ouvriers et des attelages du nouvel exploitant, et n'en demeurera pas moins soumis à la responsabilité legale résultant de son marché.

Article 25.

Si l'adjudicataire voulait établir des ateliers de distillation, ou des scieries à vapeur, il en ferait la demande en la forme ordinaire Il devrait alors accepter sans réserve les conditions qui lui seraient imposées pour éviter tout accident et tout dommage à la forêt.

Article 26.

Tout adjudicataire qui, pour cause majeure et imprévue, ne pourra achever l'exploitation ou la vidange aux termes prescrits, et aura besoin d'un délai, sera tenu d'en faire la demande au conservateur, sur papier timbré, vingt jours au moins avant l'expiration desdits termes.

Cette pétition fera connaître l'importance des bois restant à exploiter ou les quantités et espèces de produits existant sur le parterre de la coupe, les causes du retard dans l'exploitation ou la vidange et le délai qu'il est nécessaire d'accorder. Il sera statué sur son objet par le conservateur.

L'adjudicataire, par le seul fait d'une demande en prorogation de délai d'exploitation ou de vidange, s'oblige à payer les indemnités fixées par l'Administration.

Les délais d'exploitation ou de vidange courront du jour de l'expiration des termes fixés par les clauses spéciales.

Dans le cas où les adjudicataires n'auraient pas profité des délais qui leur auront été accordés, ils ne pourront obtenir décharge de l'indemnité fixée, que sur un procès-verbal de l'agent forestier local, dressé, au plus tard, le jour de l'expiration du terme de l'exploitation ou de la vidange, enregistré à leurs frais et constatant, qu'effectivement, ils n'ont pas profité du bénéfice de la décision.

Article 27.

La vidange s'opèrera par les chemins existants et par ceux qui seront désignés par le procès-verbal d'adjudication et dans l'affiche

Néanmoins, le conservateur pourra assigner, dans le cours de l'exploitation, d'autres chemins de vidange à l'adjudicataire, sur sa demande, et celui-ci sera tenu par le seul fait de cette demande, de payer l'indemnité qui serait mise à sa charge, à moins qu'il ne renonce au bénéfice de la décision.

Article 28.

Il est défendu aux adjudicataires de faire ou de laisser paître en forêt les animaux de trait ou de bât Ces animaux pourront d'ailleurs être conduits dans les ventes sans être muselés.

Article 29

Les adjudicataires feront enlever, au fur et a mesure de l'exploitation, les bois qui tomberont sur les laies séparatives des coupes, afin qu'elles soient toujours libres

Article 30.

Sont obligés les adjudicataires

1° A tenir constamment libres les chemins intérieurs des coupes ;

2° A réparer, en forêt, les voies de vidange, conformément aux indications des affiches ,

3° A rétablir les poteaux, clôtures, bornes et généralement les ouvrages de toute nature détruits ou endommagés par le fait de l'exploitation ou de la vidange.

Article 31.

A une époque quelconque du cours de l'exploitation et dans un délai de six mois après son terme, l'Administration aura le droit de procéder à un récolement de tous les arbres et bois existant sur les lots et d'y appeler l'adjudicataire, afin de procéder contradictoirement.

Article 32.

Les adjudicataires, dans les bois de l'Etat, sont tenus de payer aux communes les subventions spéciales auxquelles celles-ci ont droit en exécution de l'art. 14 de la loi du 21 mai 1836 et de l'art. 11 de la loi du 20 août 1881 pour dégradations extraordinaires causées par le transport des produits aux chemins vicinaux et aux chemins ruraux classés.

Article 33.

Toutes les dispositions du présent cahier des charges recevront leur application jusqu'à ce qu'il en soit autrement ordonné.

Les adjudicataires se conformeront au surplus aux dispositions spéciales du Code forestier et de l'Ordonnance réglementaire du 1er août 1827.

Délibéré en Conseil d'Administration, le 9 mai 1894.

Les membres du Conseil d'Administration.

SÉE — JOUBAIRE — BERT.

Approuvé :	Vu et adopté
Paris, le 16 mai 1894.	Paris, le 9 mai 1894
Le Ministre de l'agriculture,	Le Directeur des Forêts,
V. VIGER.	DAUBRÉE.

BOIS DE L'ÉTAT,

DES COMMUNES ET DES ETABLISSEMENTS PUBLICS.

ADJUDICATION DE L'EXTRACTION DES RÉSINES.

CAHIER DES CLAUSES SPÉCIALES.

CHAPITRE PREMIER.

BOIS DE L'ÉTAT

Article premier.

Les arbres à mort vendus, qu'ils aient ou non été gemmés, devront être abattus avant le 1er avril de la dernière année de l'exploitation

La coupe, pour laquelle l'usage de la scie est facultatif, aura lieu aussi près que possible de l'empreinte de délivrance apposée sur la souche, cette empreinte devra être respectée et représentée au récolement. La vidange, fixée au 15 novembre de la dernière année de l'exploitation pour les coupes d'amélioration et au 15 avril de l'année suivante pour les coupes principales (coupes à blanc étoc), est facultative en ce sens que l'adjudicataire pourra, sans encourir la penalité de l'article 40 du Code forestier, abandonner tout ou partie des produits des arbres abattus, pourvu que ceux ci aient été complètement ébranchés, mais après l'expiration des termes qui viennent d'être indiqués, les bois ainsi delaissés appartiendront à l'État, qui en disposera comme bon lui semblera

Les arbres morts sur pied, designés lors du martelage, devront être abattus dans un delai d'un mois à dater du jour de l'adjudication.

Article 2.

Si les adjudicataires désirent établir des charbonnières, ils en feront la demande par écrit au chef de cantonnement, qui designera, ou fera désigner, les lieux où pourront être pris les gazons, les herbes ou les feuilles nécessaires

Les charbonnières seront entourées, à quatre mètres de distance de leur base, par un fossé ayant 1 mètre 50 centimetres d'ouverture, 80 centimètres de profondeur, et 15 centimètres largeur au fond.

Le terrain entre la base des charbonnières et le fossé d'enceinte sera entièrement nettoyé

Les fourneaux ne pourront être allumés avant le 1er octobre, et seront éteints avant le 1er mars de chaque année.

La vidange définitive des charbons hors de la forêt devra être faite aux termes fixés à l'article premier.

Article 3.

Les baraques domaniales mises à la disposition des adjudicataires devront être entretenues pendant toute la durée de l'exploitation et remises à la fin en parfait état d'habitation.

A cet effet, le chef de cantonnement en fera remise sous inventaire à l'adjudicataire. Il constatera annuellement, avant le 1^{er} mars, les réparations à faire, et vérifiera, avant le 1^{er} avril, si ces réparations ont été exécutées par l'adjudicataire.

En cas d'inexécution desdites réparations dans le délai ci-dessus, les travaux seraient mis en régie, conformément à l'article 41 du Code forestier.

Article 4.

Tous les ans, avant le 15 juillet, l'adjudicataire fournira, façonnera et transportera gratuitement, après réception sur le parterre de la coupe, aux domiciles indiqués dans l'affiche, les quantités qui y sont indiquées, de bois refendu et écorcé, provenant de pins vifs et de qualité marchande.

Les bûches auront 80 centimètres de longueur, et au minimum 35 centimètres de circonférence moyenne après écorçage ; celles qui auront plus de 60 centimètres de circonférence au milieu, seront refendues de manière à ne pas excéder cette dimension. Le bois ainsi préparé sera empilé par stères.

Faute par les adjudicataires de se conformer à toutes les conditions stipulées ci-dessus, la fourniture sera effectuée dans les formes établies par l'article 41 du Code forestier, soit par régie, soit par marché direct.

Dans ce cas, l'évaluation insérée au procès-verbal d'adjudication, et portée sur les affiches, ne pourra, en aucun cas, être considérée comme devant limiter le montant des frais de la fourniture par régie ou par marché direct.

CHAPITRE II.

BOIS DES COMMUNES ET DES ÉTABLISSEMENTS PUBLICS.

Article 5.

Si les arbres gemmés à mort font partie de l'adjudication, les dispositions des articles 1 et 2 ci-dessus leur seront appliquées.

CHAPITRE III.

BOIS DE L'ETAT, DES COMMUNES ET DES ETABLISSEMENTS PUBLICS.

Article 6.

Les arbres à vie seront gemmés à une seule quarre, qui sera commencée au-dessus du collet de la racine et élevée toujours verticalement, savoir la première année, de 65 centimétres, chacune des trois années suivantes, de 75 centimètres, et la cinquième, de 80 centimètres, de façon à ce que la hauteur totale de la quarre soit de 3 mètres 70 centimetres

Dans le cas ou la periode de gemmage ne serait que de quatre années, la quarre serait elevée de 65 centimetres la première année, de 95 centimètres chacune des deux annees suivantes, et de 1 metre 15 centimètres la quatrième, de façon à ce que la hauteur totale de la quarre soit aussi de 3 metres 70 centimetres

La largeur des quarres ne pourra excéder 9 centimètres dans la partie inférieure de l'arbre et 8 centimètres dans la partie superieure, c'est-à-dire au-dessus de la hauteur de la quarre de la troisième année

Leur profondeur ne pourra excéder un centimètre, mesure prise sous corde tendue d'un bord à l'autre de l'entaille, à la naissance inférieure de la partie rouge de l'écorce

Les quarres jusqu'à la quatrième inclusivement seront pratiquées, autant que possible, aux extrémités de deux diametres perpendiculaires l'un à l'autre

Les quarres anciennes seront abandonnees, quelle que soit leur hauteur

Article 7.

L'operation du gemmage sera limitee entre le 1^er^ mars et le 15 octobre de chaque année, mais l'adjudicataire pourra commencer à racler les pins qui devront être resinés, et à placer les crampons, dès le 10 fevrier

Il pourra aussi récolter le barras jusqu'au 31 décembre de chaque annee de la periode de gemmage excepté la dernière annee, où cette opération devra être terminée le 15 novembre

Article 8

L'adjudicataire pourra elaguer les arbres à vie jusqu'à la hauteur de 4 mètres 50 centimètres

Article 9

Chaque adjudicataire aura la faculté de construire, dans son lot et sur l'emplacement qui lui sera designé par les agents forestiers, des baraques pour servir au logement des résiniers. Ces baraques auront les parois de la cheminée en pierres ou en briques, et seront recouvertes en tuiles L'adjudicataire sera tenu de les démolir et d'en enlever les materiaux dans les deux mois qui suivront le terme fixé pour l'achèvement de la vidange ou du gemmage, faute de quoi et passé ce délai, les constructions appartiendront au propriétaire de la forêt.

Article 10.

L'adjudicataire ne pourra traîner les corps d'arbres que sur une autorisation speciale du chef de cantonnement

A moins d'indications contraires portées sur les affiches, les bois pourront être enlevés au moyen de voitures A défaut de chemins ouverts, ces voitures suivront les tracés qui seront désignés.

Article 11.

Le minimum des indemnités à payer par l'adjudicataire, dans le cas prévu par l'article 28 du cahier des charges, est fixé ainsi qu'il suit, non compris les frais de timbre et d'enregistrement du procès-verbal de constatation

0f. 25c pour les brins de 0m. 20 à 0m 50 de circonférence ;

1f. 50c pour les arbres de 0m. 51 à 1m ,

6f. 00c pour ceux de 1m 01 à 2m ,

10f. 00c pour ceux de 2m. 01 et au-dessus

La circonférence des arbres sera mesurée à 1 mètre du sol.

Dans le cas ou les arbres auraient disparu, leur circonférence sera mesurée à la souche ou évaluée par l agent forestier local

Article 12

Les travaux imposés sur les coupes seront exécutés jusqu'à concurrence des sommes portees sur l'affiche, pour les coupes vendues, et sur le permis d'exploiter, pour celles délivrées en nature, à la diligence et sous la direction des chefs de cantonnement, par des ouvriers choisis par lui, et aux époques qu'il jugera le plus convenables.

Les adjudicataires ou entrepreneurs paieront les ouvriers au vu des certificats de réception délivrés par cet agent, et qui vaudront décharge.

En cas de retard de paiement, le mémoire des sommes dues sera arrêté par le Préfet, et rendu par lui exécutoire contre les adjudicataires ou entrepreneurs.

Propose par les Conservateurs des Forêts soussignés

Bordeaux et Pau, le 4 avril 1894.

E MUEL.—E. De GORSSE.

Approuvé

Paris, le 18 Mai 1894

Le Directeur des Forets,

DAUBRÉE.

DRY DISTILLATION OF WOOD AND THE RESULTING PRODUCTS

As every student of chemistry knows, the following separations take place when wood, shut off from air, is exposed to high temperatures —

I. Uncondensable gases (20 to 35 per cent, of the weight of the wood). Carbon monoxide and dioxide, free hydrogen, acetylene, propylene, benzol, etc

II Tarry Matters (3 to 9 per cent), such as benzol, naphthalin, paraffin, phenol, cresol, pyrocatechin, some ethers, pyrogenated resins, etc.

III Pyroligneous Acid (35 to 45 per cent), which contains, besides water, acetic acid, methylic and allylic alcohol and acetone, various oily acids, phenols, pyrogenated resins, etc.

IV Charcoal (20 to 30 per cent.).

The products under II and III collect together in the distillate which settles into three layers The uppermost layer consists of the light tarry oils with a little acetic acid in dissolution, the middle layer is the so called pyroligneous acid, which contains, besides the products mentioned under III, some dissolved tarry matters, while the lowest, the tar, comprises the heavy creoseted oils saturated with acetic acid

The slower the distillation, the less the quantity of uncondensable gaseous products but the greater the proportion of distillate (and of course of acetic acid, alcohol and tar) and the more and harder the charcoal

The middle stratum of the distillate is utilised directly for preserving meat, wood, cordage, etc., but its principal use is for the manufacture of (1) concentrated acetic acid employed in the preparation of aniline dyes, (2) of vinegar, (3) of wood spirits, (4) of various acetates, of which immense quantities are consumed in the dyeing and cloth-printing industry, and which may even be used impure, in the form, *e.g*, of pyrolignite of iron and of alumina (iron and alum mordants), and (5) of various other acetates, such as the neutral acetate of lead.

At M Geoffroy's Works at Chatel near Épinal I was able to study not only the system of dry distillation of wood employed by him, but also the manufacture of acetate of soda and of wood spirits. Up to recently he made also acetic acid, but he finds that it pays better to prepare only the acetate, which is entirely exported to England. The factory is also fitted up for creosoting wood, but a few years ago the railway companies established their own works for creosoting sleepers, and this part of the factory is therefore now closed. I will consequently describe only M. Geoffroy's method (1) of distilling wood, (2) of preparing acetate of soda, and (3) of distilling wood spirits; and after that briefly explain how the potable and non-potable acetic acids are made

I.—Distillation of Wood.

The illustrations on the following page represent fairly accurately the apparatus used.

The wood, mere branch wood not exceeding 6 inches in girth, is packed upright tight in a cylindrical iron vessel (see V in Fig. 1) which forms the receiver of the retort and which is about 5 feet high and 40 inches inside diameter, and therefore contains about 30 solid cubic feet of wood. The vessel is furnished with a strong projecting rim, upon which fits exactly a similar rim of the cover. The cover is fixed in the way shown in Fig. 2.

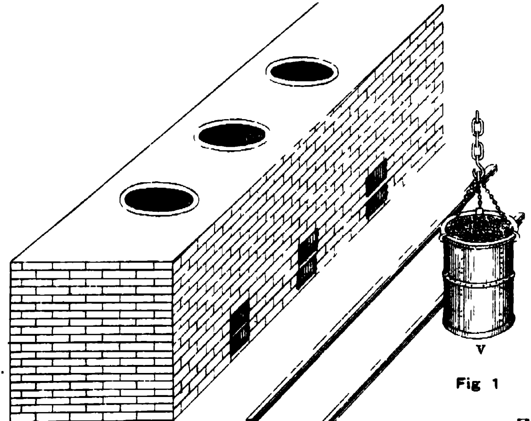


Fig 1

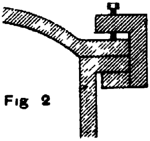


Fig 2

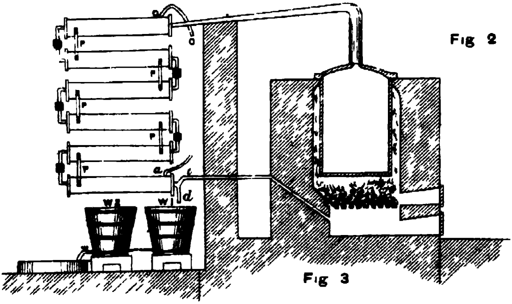


Fig 3

When the vessel has been filled with wood, it is lifted up by a travelling crane which runs on rails laid alongside of the raised furnace and let down into one of the circular openings of the furnace. The cover is now fitted on and the retort tube fixed and connected with the condenser (see Fig 3). The joints and air-spaces between the rim of the retort and the furnace are completely stopped with luting.

For obvious reasons the condenser is placed outside the furnace room The tube of the condenser, instead of being coiled into a worm, is bent into several zig zags, the horizontal portions of the zig-zags being enclosed in cylinders which intercommunicate by means of the connecting pipes (p, p p) The cold water enters the lowest cylinder at *a* from a cistern placed above the level of the highest cylinder, and passes successively fr m the lowest to the highest, being helped in this upward passage by the circumstance that the density of water is in inverse proportion to its temperature It flows out at *o*

The distillate on the contrary, passess down the zig-zags along with the uncondensable gases The distillate continues to flow downwards and drops through the tube *d* into the vat W 1, while the gases escape upwards through the curved tube *t*, which conveys them under the hearth of the furnace, where they are thus utilised

The object of the second vat is to secure the complete settling of the distillate, the heavy tarry matters being drawn off through the tap, while the oils floating on the top can be skimmed off from the first vat, in which they are mostly left behind.

The distillation is effected at temperatures varying between 600° and 900° C, according to the wood used, and is completed in about 11 hours The distillate is a deep brown liquid having an acidulated taste and the flavour of tar and smoke

II —Manufacture of Wood Spirits (Methylic Alcohol).

The distillate must now undergo a process of distillation in order to separate the alcohol The still used is of the ordinary pattern with a worm condenser, but a little beyond the bend of the retort tube are fixed three copper plates which are constantly kept cool by a current of cold water. As the point of condensation of watery vapour is about 33° C higher than that of spirit vapour, the vapour passing up from the boiler parts with a considerable proportion of its watery portion by condensation over the copper plates, so that what issues from the worm is fairly strong alcohol The distillation is continued until no more spirit vapour pass over into the condenser—a circumstance which is ascertained either with the aid of an alcoholometer or by pouring a few drops of the condensed liquid on live charcoal

The spirit thus obtained still contains not only a large proportion of water, but also many impurities, such as a little acetic acid, methylacetic ether, aldehyde, some carburets of hydrogen, methylamine, allylic alcohol, etc To remove these extraneous substances, the crude spirit is digested in a closed vessel with lime, which sets free ammonia and methylamine. In addition, the acetic acid becomes saturated with the lime, the methylacetic ether is split up into methylic alcohol, etc., and the acetone is transformed into various less volatile substances At the end of a few hours the mixture is distilled in a special apparatus consisting of three distinct parts as follows —

(*a*) A boiler heated with steam.

(*b*) A rectifying apparatus in the form of a hollow cylinder kept cold by a current of water and terminating at its lower extremity in an egg shaped vessel, into which open two tubes, whereof one brings in the vapour from the boiler and the other serves to take back into the boiler the liquids condensed within the cylinder

(*c*) A worm for condensing the vapours that do not condense in (*b*) and therefore continue to pass on

The distillate thus obtained, which marks 90° to 95° Baumé in the alcoholometer, contains hardly anything besides methylic alcohol, acetone, a little methylacetic ether, aldehyde, water, and a very small proportion of hydrogen carburets, and is quite pure enough to be burnt in lamps

For further purification, the liquor is diluted with water until it marks 50° Baume As a result most of the carburets become separated and form in a few hours an oily film on the surface The liquor below is drawn off through a tap and, mixed with 2—3 per cent of lime, is subjected to a further rectification in the same distillation apparatus in which the first rectification was effected The distillate is still not quite pure, but pure enough for many industrial purposes, such as the manufacture of varnishes.

Finally, a third rectification is effected in the same apparatus, in the presence of a little sulphuric acid, at a temperature between 46° and 67° Even now the alcohol contains some traces of acetone, but it is sufficiently pure for its two great uses, *viz.*, in the manufacture of the methylated colours extracted from coal-tar (aniline dyes) and of methylic ethers employed in ice-machines.

To remove the last traces of acetone, the wood spirit can be further treated, after Rotten's process, with chlorine and rectified over again, but M. Geoffroy finds it unnecessary to prepare such a perfectly pure spirit

When pure, wood alcohol is a colourless liquid with a specific gravity of 0 814 and boiling at 66 5° C

One hundred solid cubic feet of wood yields from 2½ to 4 gallons of spirit, according to the character of the distillation of the wood

III —MANUFACTURE OF ACETATE OF SODA

On page 66 it has been described how the alcohol is separated from the direct product obtained from the dry distillation of wood What is left behind in the boiler is principally pyroligneous acid with some tarry matters These latter for the most part sink to the bottom on cooling, and are easily removed, as they are the first to flow out when the tap in the bottom of the boiler is opened.

The pyroligneous acid is poured into a wooden vat and is gradually saturated with pure sodium carbonate As the solution loses its acidity, it becomes covered with thin plates of tarry matter which are at once skimmed off When the liquor is thus cleared, it is concentrated in iron pans to the consistency of 27° Baumé, skimming being continued until the end

This liquor is then kept from 6 to 10 days in flat pans to crystallise. When the crystals have formed, the liquid portion is drawn off

The crystals are then redissolved to 27° B, and this solution also is left to crystallise This time the crystals are much larger than before, but still brownish owing to tarry impurities. They are redissolved, but only in their water of crystallisation, by heat, and the solution is calcined, a little at a time, in a pan containing a mechanical agitator, at a temperature of 380° and upwards but not exceeding 400°, at which point the acetate would be decomposed The acetate, continually stirred during the process of torrefaction, collects in ball-shaped masses which dissolve gradually, while the tarry matters get burnt out and volatilised At the end of about 1½ hours the salt is sufficiently roasted, and it is then ladled out on to cast-iron plates to cool and solidify

When cool, it is redissolved in boiling water. The solution, after being allowed to settle, is decanted and filtered, first through wire netting and then through animal charcoal, and finally evaporated to crystallisation (27° Baume). The salt is now suited for the manufacture of the purest acetic acid, but the crystals are large and not yet quite white

Torrefaction is a risky process, for if by any chance the temperature rises to 400° C, the salt gets decomposed Hence two other processes are often substituted for it.

In the first the brown crystals of second crystallisation are redissolved to 16° Baumé and filtered through a thick layer of granular animal charcoal The solution being evaporated, the new crystals, after being washed and drained, are sufficiently pure for making with it potable acetic acid and are perfectly white The charcoal is washed in boiling water and from time to time recalcined to clean it The water resulting from the washing is used in making the solution of 16° Baumé.

In the second method the brown crytals of the first crystallisation are dissolved and the solution treated with tannin or with ground wood containing tannin (wood paste) The tannin precipitates the tarry matters, which are then removed either by decantation or filtration Evaporated and recrystallised, acetate of soda of sufficient purity is obtained for the manufacture of potable acetic acid. This method will be the best adapted for India, where tanning materials are superabundant and cost next to nothing to procure.

IV.—MANUFACTURE OF NON-POTABLE ACETIC ACID.

This is made with calcium acetate, which is thus prepared :—

Take the crude acetic acid from the boiler after the alcohol has been driven off (see page 66), saturate it with slaked lime and evaporate in a boiler over a naked fire until the mass is reduced to a paste, which desiccate in flat pans, constantly stirring with an iron spatula.

The calcium acetate is decomposed in hydrochloric acid (90 to 95 parts acid at 20° Baumé to 100 parts of acetate) and the mixture left undisturbed for 12 hours The tarry matters that have risen to the surface are then skimmed off and the solution is distilled over a naked fire in a copper boiler in order to separate the acetic acid now rendered free The distillate still contains some hydrochloric acid and oily matters To rectify it, it is redistilled in a copper report heated with steam. In spite of all rectifications the acid thus prepared has always an empyreumatic flavour and cannot be used for culinary purposes, but is perfectly suited for employment in the arts.

V.—MANUFACTURE OF POTABLE ACETIC ACID

The several processes in which heat is employed although very simple, suffer from the capital drawback that they yield a product which always possesses a peculiar flavour that is not pleasant The following cold process, invented by Mollerat, is one of the best

It requires small white crystals of the acetate, hence the crystals obtained by the method of manufacture first described (page 68) are not suited unless they undergo a further stage of manipulation Instead of allowing the large crystals to form, the solution is constantly stirred by means of a mechanical agitator By this means smaller and white crystals are formed, which are washed in a solution of pure acetate of soda and drained and dried in trays with a pierced bottom

The acid is thus prepared The small white acetate crystals are mixed, in a vat possessing a false bottom pierced with holes, with 35 per cent of their weight of sulphuric acid At the end of about 12 hours the sulphuric acid will be found to have set free the acetic acid, while the neutral sodium sulphate which has formed at the same time has, owing to its very slight solubility in acetic acid, crystallised almost in totality By opening a tap fixed below the level of the false bottom, the acetic acid is completely drawn off The sulphate residue in the vat is washed with water, which also is drawn off in the same way, and contains some acetic acid and relatively more of the sulphate than the first draw.

To remove the sulphate the acid is put into sandstone jars kept in a running stream of water as cold as possible, or, in the absence of such a stream, in a refrigerating chamber the temperature of which is kept just below freezing point At the end of 8 to 10 days the greater portion of the sulphate becomes precipitated in the form of crystals, and the acid, now nearly pure, is decanted To get rid of the remaining sulphate a quantity of calcium acetate just sufficient to decompose this sulphate is added, calcium sulphate being at once formed and precipitated It is impossible to help putting in a slight excess of the calcium acetate, which therefore remains in solution in the acetic acid , but this small quantity has no drawbacks at all

VI —APPLICATION OF WHAT PRECEDES

For the manufactures described in this paper nothing more than mere firewood of small dimensions is required. Of such wood we have thousands of tons everywhere, for which there is no demand and which must therefore rot in the forest or feed the annual conflagrations, besides impeding reproduction and preventing us effectually from making cleanings and thinnings.

The plant required in the various processes is also all of a very inexpensive kind Hence the necessity of making a beginning somewhere ; the State having given the start and shown the way, private enterprise would not be long in stepping in.

The best place for the experiment would be some district of the Central Provinces not too far from the neighbourhood of a coal mine, so that there may be every inducement to undertake later on the preparation of aniline dyes.

Cloth printing has already been started in Bombay. Cheap mordants in abundance would have the effect of causing the industry to expand into vast importance, seeing how enormous the home demand for printed cloths is And here we have a further justification for establishing the first wood distillery in the Central Provinces in the very midst of the cotton mill industry.

STREET WOOD-PAVEMENT IN PARIS.

The first wood pavement in the streets of Paris was laid down only shortly before 1883 On 1st January of that year there existed, in round numbers, only 1,600,000 square feet of it, but by 1st January 1895 the superficial extension had attained to nearly 92,000,000 square feet, capable of giving a roadway, 60 feet wide, of close upon 290 miles And yet the proportion of wood to other kinds of road covering is still barely as 1 to 12. Appendix I shows diagrammatically the annual extensions from 1889 to 1895 This rapid development has been due as much to the higher cost of asphalte pavement as to the absolute recognised superiority of wood Asphalte is again being brought into competition with its rival. The contractors for asphalte, after trusting for 12 years to see a natural reaction against the new system set in, have at last grown desperate and determined to tempt the Municipality to resume asphalte extension by lowering their rates down to the level of wood pavement They cannot, however, hope to do anything more than merely retard the present rapid rate of development of the wooden roadway, the final triumph of which at a not remote date is inevitable For wood is as much superior to asphalte as asphalte is to stone, it is far less noisy, less slippery (especially during frost), less trying to the feet and legs of horses and less jarring for wheeled traffic, although it is certainly more difficult to wash (the method of cleaning streets in Paris) and dries less readily. It has been urged against it that it harbours and spreads the microbes of epidemic disease, especially of influenza, but this charge is entirely unsupported by the special researches of bacteriologists, as will be observed on a study of Appendix II

Wood pavement is so much in favour that the Municipality is prepared to relay with it any street that is at present otherwise paved, provided the inhabitants or house-holders are willing to contribute one-third of the cost of such relaying This of course does not refer to the larger thoroughfares, all of which the Corporation is endeavouring to cover with wood at its own expense as quickly as its resources allow The fact that the public have co-operated with the Municipality in paving with wood some of the minor streets is the best proof of the high estimation in which wood pavement is held

The cost of laying down 1 square metre of roadway for the first time is as follows, the wood used being cluster pine from the Landes cut into blocks 15 centimètres (6 inches) high :—

Layer of concrete 0 15 m. (=6 in) thick .	4 50 francs	= 3 6 shillings
The wood (original cost 8 francs), cutting, creosoting and carriage .	10 00 „	= 8 0 „
Laying roadway and gravelling . .	1 20 „	= 1 0 „
Total . .	15 70 francs	=12 6 shillings

This is equivalent to 14*d* per square foot

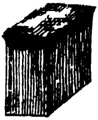
The cost of renewing with similar wood is—

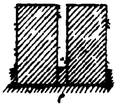
Pulling up old pavement . . .	0·80 francs	= 2·9 pence
Carrying it away . . .	0·20 „	= 1·9 „
Cost of new blocks and laying (as above) .	11·20 „	= 107·5 „
	11·70 francs	= 112·3 pence
Minus value of old blocks still useful . .	1·50 „	= 14·4 „
Total .	10·20 francs	= 97·9 pence

or 9·1*d* per square foot. All blocks, still sound and not worn down to less than 12 centimetres (4·7 inches) are used again in a street with light traffic, after being reduced to that height

Thus the blocks are of two different heights according to the weight of traffic the pavement has to carry On their cross section (transverse to the run of the fibres) they are of course all of an uniform thickness 8 centimètres (3·1 inches), so that they may be laid in regular rows across the road, whereas, in order to be able to break joint wherever necessary and to finish up a row exactly without having to split up some of them they are cut to four different lengths, *viz*, 25, 22, 19, and 17 centimetres (9·8, 8·7, 7·5, and 6·5 inches)

It has been usual to lay the blocks close up against each other, but it has been found that under the pressure and shock of traffic the tops of the blocks of all soft woods and even of some hard woods get forced out into a mushroom shape the projections from adjacent blocks meeting across the joints. This circumstance has been taken advantage of to lay two consecutive rows of soft wood blocks about half an inch apart, separating them with a lath (*e* in adjoining sketch), and filling up the empty space above the lath with gravel and sand.





For a wood to be suitable for street paving it should possess the following characters —

1. It should be able to resist wear and tear as much as possible — Resistance to wear and tear is a function of density, hardness and resistance to crushing (under compression as well as shock) combined The pavement of streets through which tramways, especially horse tramways, run and where heavy vehicles are constantly stopping and starting, should be of the most resisting wood Even when the tramcars are propelled with steam or electricity, the perpetual crossing and recrossing of the rails by other vehicles soon wears away and breaks up the blocks close to the rails, which blocks are moreover already sorely tried by the oscillations of the rails under the moving heavy cars. A horse or horses dragging the cars and always trotting along the same line, obviously makes matters still worse In Paris, in streets laid with a tramway, pine blocks last only three years In London, where the omnibuses stand opposite the Charing Cross Station, pine lasts only one year A hardwood pavement not only generally absorbs less moisture than one of a soft wood but also dries up quicker—a circumstance which adds to its already superior wearing qualities. The possibility of using over again old blocks, slightly cut down, in another roadway with lighter traffic is an additional point in favour of hard resisting wood. On the other hand, the wearing power of a soft wood, provided it is not too soft, can be considerably increased by scattering over the pavement, from time to time, small *débris* of a tough porphyritic rock, which, being forced into the wood by the traffic, form with the fibres thereof a thin, but highly resisting, macadamised-like protective layer.

II. *The surface of each paving block should wear away evenly.*—In the case of oak wood the blocks wear away, under the feet of horses, chiefly along the edges transverse to the axis of the road, thus producing the so called "corduroy" surface so trying to horses. For this reason oak is never used.

III. *The wood should resist decomposition well.*—It is evident that the paving blocks are placed in the most unfavourable conditions to resist decomposition: not only are they subject to great alternations of humidity and dryness, but they are constantly in contact with and absorbing the highly putrescible dejecta of animals. They should remain sound for at least the period during which they are to remain in the two roadways which they are successively to cover. This period, the traffic on one of the roads being light and with wood that wears well, may extend beyond 20 years. It is therefore usual to impregnate the soft woods. This was at first done in a complete manner, but experience has shown that mere soaking for a quarter of an hour in creosote secures the desired degree of immunity. The creosote enters about 2 inches in the direction of the fibres but the penetration continues for days afterwards, so that ultimately only a very small proportion of the interior of the block remains unaffected. This method of impregnation costs about 4s per 100 square feet of pavement and will be found fully described in Appendix III. The impregnation of hardwoods would be too costly, and indeed, has not been found necessary. M. Petsche tells me that the only form of decomposition hitherto observed has been dry rot, and this only in blocks which were already affected before being laid down. Nevertheless, I think further observation is necessary. Beech rots in a few years and is therefore utterly unsuitable.

IV. *The wood should not make too smooth a surface in dry weather or too slippery a surface in wet weather.*—A slight woolliness of surface due to the possession of tough, long fibres, is desirable in both kinds of weather, as it not only offers more friction, but also renders possible the formation of the peculiar macadamised-like layer, already referred to under II on the preceding page, which prevents slipperiness in wet or frosty weather. A wood that always wears away smooth under traffic is specially unsuited for animals. Oak possesses this defect, whereas the wood of the various Eucalypti, although not less hard than oak, forms a rough surface.

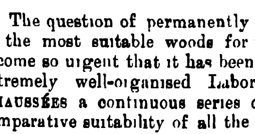
V. The wood should be of more or less uniform density, not only through the whole of a tree, but also throughout a whole forest otherwise the various blocks laid together, wearing away unequally as they would do, would give rise to great inequalities of surface and even holes, and thus necessitate frequent renewals. This is a very general defect in cluster pine which, considering its great cheapness, would otherwise be an excellent paving material

VI. The wood should not be too absorbent of moisture, otherwise not drying quickly, it would not only be specially liable to rot, but also offer diminished resistance to physical degradation, besides tending to form a slippery surface and influence health unfavourably

VII *The force of expansion, while absorbing moisture, should not be excessive*—The very remarkable fact should here be stated that this force is quite independent both of the quantity of water absorbed and of the increase of volume consequent on such absorption The force of expansion is an important factor for consideration in roads laid with a tramway and in the roadway over bridges In general it is less in laid woods at the commencement of absorption, but attains a higher maximum, which is however reached later

VIII *Increase of volume on imbibition of moisture should not be excessive*, otherwise there would be a tendency for the road-covering to rise up away from the underlying layer of concrete besides producing dangerous lateral thrusts as in the case of the expansive force referred to under VII The evil can, however be remedied or sufficiently mitigated by not laying the blocks hard up against one another, and, if possible, using laths as described on page 69, and, as expansion is greatest in the direction at right angles to the radial run of the medullary rays, and in most of the blocks these rays run in the direction of the road, also by laying one or two rows of blocks lengthwise along the edge of the roadway (see sketch opposite), one of such rows being removed, when necessary, in order to counteract the lateral expansion of the mass of blocks covering the roadway

Edge of Roadway



The question of permanently assuring a sufficient and cheap supply of the most suitable woods for paving the streets of Paris has already become so urgent that it has been found necessary to institute in the extremely well-organised Laboratory of the École des Ponts et Chaussées a continuous series of careful experiments to ascertain the comparative suitability of all the various woods offering in the market These experiments have only just been commenced, but already afford sufficient data to justify certain conclusions being drawn with regard to nine different kinds of wood The method of experimentation is described in Appendix IV, while Appendix V is a Report in which M. Petsche, the Engineer through whose kindness I have been able to study the present question, sums up the results of the experiments made up to date This Report is of special interest to the Indian forester, shewing as it does the high position iron wood and teak secure as the result of the experiments. There can be no doubt but that we have numerous other woods, growing gregariously over extensive areas, which would yield as favourable results, and M. Petsche has kindly offered to test them for us in the most thorough manner possible, if we send him a quantity of each sufficient not only for the laboratory experiment, but also for trial in selected sections in the streets For this latter purpose 3,000 square feet of paving would be ample, requiring, allowing for waste in sawing, about 1,500 cubic feet, while the small pieces wasted in the sawing would serve for the laboratory experiments.

Should the quantity of all the different woods together sent to him be somewhat large, I feel certain that he will be only too glad to pay cost of carriage and customs and octroi duties The freight to Havre will not probably exceed 16*s* a ton, and from Havre to Paris will be about 6*s* a ton The French customs charge a duty of 11.26 fr. (=9*s*) per cubic metre (=35½cubic feet) on hard woods and 9 fr. (=7 1*s*) on soft woods, while the Paris octroi on wood of all kinds is 1*s* per 100 kilogs (=220lb *). Thus the total charges up to Paris will amount to roughly 45*s* (=54 fr) per cubic metre. Now as the Municipality already pays 58 fr for cluster pine, 85 fr for pitch pine, 130 fr for hem (from Tonquin), 95 fr for some unknown kinds of wood from the Congo, and 130 to 145 fr for Jarrah and Karri, the Engineer would lose nothing by having to pay 54 fr. per cubic metre for a trial consignment from India, which may prove the means of assuring him a permanent supply of the best woods available for his purpose

Not being sure that the Government of India would consent to the despatch of this trial consignment, I have been diffident to sound M. Petsche on the subject, but I should be very glad to undertake to do so whenever I receive the necessary authorisation Should the trial consignment prove successful, as there is every reason to believe that it will do, we should secure not only the Paris, but also the London market (combined demand a good deal in excess of 2,000,000 cubic feet per annum) and thus have an outlet for the large stock of woods for which there is at present little or no demand It may appear unpatriotic to send the trial consignment to Paris, but there is in London no place like the Laboratory of the ÉCOLE DES PONTS ET CHAUSSÉES, where the woods could be tested so thoroughly, and we have in M Petsche's letter to me of 8th May 1895 (Appendix VI), an ~~assurance of~~ complete willingness (*empressement*) on his part to undertake to carry out the tests.

The Paris Municipality possesses its own factory for cutting the various-sized paving blocks The home grown wood is received in squared logs of all sizes, the imported wood in planks of various lengths of a uniform thickness of 8 centimètres (3 15 inches) and mostly 25 centimètres (nearly 10 inches) in width. This accounts partly, but of course only to a comparatively slight extent, for the great differences in the prices paid for home-grown wood and that from Australia

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* My authority for these figures is M Petsche himself

Although complete authoritative data are still wanting, yet what has already been ascertained in London and Paris justifies the belief that Jarrah will last at least two and a half times as long as cluster pine. Now the figures given above on page 72 and in Appendix VII show that the cost of relaying a square metre of cluster pine pavement is only 1 franc (about 10*d*) less than the cost of original laying, being 10·20 fr in the one and 11 20 fr in the other, the wood in each case costing, creosoted, 8 50 fr It will thus be seen that even with present prices, Jarrah is much less expensive than pine, so that if our woods do not prove worse than Jarrah and fetch only 130 fr a cubic metre, the net price that we would realise, allowing 80 fr for all expenses, would be 50 fr per cubic metre, or about R1 per cubic foot As I have taken outside figures for expenses, the probability is that the net price realised would exceed R1

I trust therefore that Government will consent to a trial consignment being sent to M Petsche from either Burma or the Andamans His address is—

Ingénieur ordinaire de la 3 eme Section
des Travaux de Paris (Voirie et Travaux d'Ingénieurs),
Prefecture de la Seine,
59, Rue du Faubourg St Martin, 59,
Paris

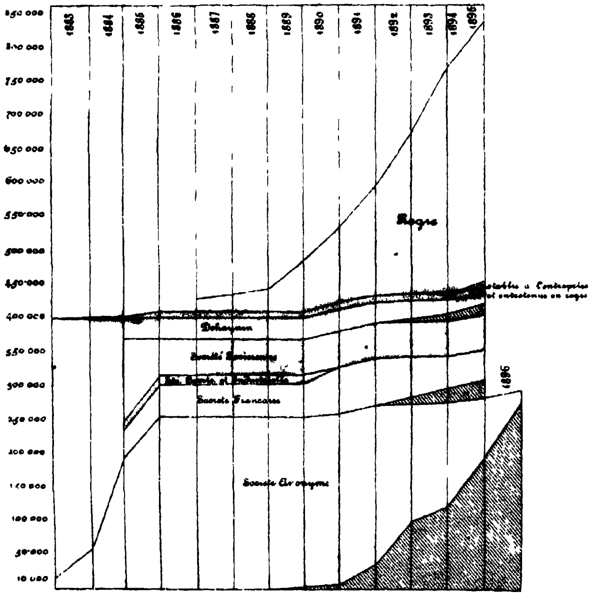
APPENDIX I.

Pavages en Bois.

Diagramme des accroissements des surfaces de chaussées pavées en bois soit concédées, soit exécutées et entretenues en régie à Paris.

(Pavages neufs et relevés-à-bout)

Surfaces exécutées aux 1er Janvier des années.



Nota — Les parties hachées concernent les relevés-à-bout

Echelle des ordonnées 0.002 pour 10 000 m. q.

APPENDIX II.

Result of Bacteriological Examination of Wood Pavements.

Paris, le 4 mars 1895.

Rapport préliminaire sur la pénétration des micro-organismes dans les pavés de bois

Technique —On prélève aseptiquement, autant que cela est possible dans une atmosphère toujours chargée de 5 à 6,000 bactéries par mètre cube, 1 décigramme de sciure de bois au fond d'un trou foré dans le pavé avec une mèche stérilisée au feu et refroidie, on dilue cette sciure dans 100 centimètres cubes d'eau stérilisée et l'on ensemence, après une agitation prolongée, cette eau sous un volume connu dans de la gélatine nutritive purgée de tout germe. Le nombre des colonies bactériennes et le nombre des moisissures est compté après une durée d'inoculation de 30 jours à la temperature de 20 à 22°

1° Pavés neufs.

Experience I —Pave neuf, pin gemmé. La prise d'échantillon de sciure est faite à 3 centimetres de profondeur dans un angle du pavé

Résultat.

1 gramme de sciure de bois prise à la profondeur indiquée accuse 650 bactéries, c'est à dire moins d'une bacterie par milligramme.

Experience II —Pavé neuf, pin non-gemmé La prise d'échantillon de sciure est faite a 5 centimètres de profondeur au centre du pavé.

Résultat

Le gramme de sciure prise à la profondeur sus-indiquée a accusé 1,080 bactéries

Ces chiffres montrent que les pavés neufs ne contiennent dans leur masse qu'un nombre fort restreint de bactéries, et il est bon d'ajouter que le mode d'expérimentation adopté, qui nécessite un travail au contact de l'air, des pesees delicates à la balance, expose l'opérateur à trouver des erreurs voisines du chiffre 1,000 per gramme de sciure manipulée

2°. Pavés anciens.

Relativement à ces pavés, le même mode opératoire a été suivi, avec cette différence que l'on enlevait par le grattage sur une épaisseur de 1 à 2 millimètres la couche de bois superficielle incrustée, par le roulage, de terre ou de fragments de gravier.

Expérience I.—Pavé, pin des Landes, établi le 1er janvier 1887, rue du F^{g}. St. Honoré, 154

Résultats.

1 gramme de sciure prise à la surface contenait 1,400,000 bactéries.

1 gramme de sciure prise à 2 centimètres de profondeur contenait 4,200 bactéries

1 gramme de sciure prise à 5 centimètres de profondeur contenait 4,200 bactéries

Expérience III—Pavé ancien, pitch pin, 2^me^ choix, établi rue Saint-Lazare et rue de Rome, 1, en 1889

Résultats

1 gramme de sciure prise à la surface contenait 1 004,000 bactéries

1 gramme de sciure prise à 2 centimetres de profondeur en accusait moins de 500

1 gramme de sciure prise à la profondeur de 5 centimètres, même résultat

Expérience III—Pavé ancien, pin des Landes, établi rue Marbeuf in 1886.

Resultats

1 gramme de sciure prise à la surface contenait 1,365 000 bactéries

1 gramme de sciure prise à 2 centimètres de profondeur en contenait 4,200

1 gramme de sciure prise à 5 centimètres de profondeur en contenait 3,100

Ces résultats montrent jusqu'à l'evidence que les micro organismes de l'ordre des bactéries ne pénetrent pas ou presque pas dans la masse des pavés de bois, qu'ils restent adherents à la couche superficielle soumise au roulage qui se montre chargee d'environ 1 à 2,000 000 de germes par gramme de sciure de bois Comme indication, il est bon d'ajouter que la boue des rues dessechée à la temperature de 30 à 35° accuse une moyenne de 40 à 50,000,000 de bacteries par gramme de boue pulvérisée

Expérience IV—Cet essai vient encore confirmer la conclusion qui précède.

Un pavé de bois neuf, pitch pin, 1^re^ choix, est immergé sur une hauteur d'environ 2 à 3 centimètres dans un cristallisoir contenant du bouillon de bœuf en putréfaction, il y reste abandonné pendant 30 jours, après quoi il est séché doucement à l'étuve

Resultats

1 gramme de sciure prise directement à la surface accuse 17,000 bactéries

1 gramme de sciure prise à 2 centimetres de profondeur accuse 220 bactéries.

1 gramme de sciure prise à 5 centimètres de profondeur accuse 330 bactéries

Tels sont les premiers faits importants à connaître, à savoir que durant leur service, les pavés de bois ne sont pas penétrés par les bactéries et qu'ils résistent pendant plusieurs annees (7 à 8 ans), à l'infection par cette classe de micro-organismes

PARIS, LE 4 MARS 1895

Le Chef du Service Micrographique,

Signé **MIQUEL.**

APPENDIX III.

Note on the Present System of Creosoting Wood Paving Blocks.

Il est intéressant de faire connaître les résultats obtenus par la modification du système de créosotage à l'usine de fabrication de pavés de bois.

Depuis la création de l'usine, 1886, le créosotage a eu lieu par la simple immersion dans de grandes cuves remplies d'huile lourde, des pavés que l'on retirait ensuite à la main pour les charger en wagonnets et les conduire aux piles. Le créosotage ainsi obtenue est naturellement assez élémentaire, puisqu'il n'est pas fait sous pression; il était peu homogène à cause du flottage des pavés. On avait essayé de rémédier à cet inconvénient par l'emploi de lourds chassis, manœuvrés par des palans et un treuil à engrenage, qui venaient faire plonger les pavés; mais cette manœuvre était laborieuse et bien dangereuse pour les ouvriers et on a dû vite renoncer à son emploi Ce mode de créosotage conduisait à des manutentions coûteuses, fâcheuses pour les ouvriers dont les mains étaient en contact continuel avec la créosote et le visage exposé aux éclaboussures d'un liquide corrosif. Enfin l'égouttage des pavés sortis de la cuve occasionnait une perte importante de matière, et souillait toute l'usine. Tout en nous réservant notre opinion sur l'utilité, au point de vue de la conservation des chaussées, d'un créosotage élémentaire sans pression, et en nous proposant d'examiner s'il ne conviendrait pas ou d'adopter un créosotage par le vide et la pression, ce qui exigerait une installation importante, ou de renoncer purement et simplement à l'impregnation, nous avons voulu réduire les inconvénients du système en usage. Aux wagonnets ordinaires de transport, ont été substitués des wagonnets spéciaux construits par les ateliers Décauville Ils comportent une caisse en tôle étanche et à bascule de 1,080 litres de capacité (dont 864^{l} utilisés), dans laquelle, en l'inclinant, sont rangés à la sortie de la scie les pavés; la caisse redressée, un couvercle à claire voie y est fixé par des broches.

Le wagonnet ainsi chargé est est amené sous un réservoir rempli d'huile lourde (de 3,000^{l} de capacité) muni d'un robinet à débit rapide. Deux ou trois minutes suffisent pour remplir la caisse; on laisse les pavés en contact avec le liquide pendant 5 à 10 minutes, pendant que d'autres wagonnets viennent au remplissage. L'imprégnation faite, on fait avancer le wagonnet de quelques mètres, on ouvre les robinets établis au fond de la caisse, et l'huile lourde s'écoule dans des réservoirs inférieurs; puis le wagonnet poursuit sa route jusqu'aux piles où le déchargement et l'empilage s'opérent en prenant les pavés à la main dans le wagon.

Du réservoir inférieur, l'huile lourde est élevée, par une pompe Dumont No. 0 (9,000^{l} à l'heure) actionnée par la transmission de l'usine, dans le réservoir supérieur ou elle arrive décantée et filtrée par le passage à travers une crépine.

On a commandé de suite 6 wagons à 395 f. Chacun pèse 480^{k}, et est facilement poussé par 2 hommes. Le réservoir monté sur pylone a coute 975f, on a utilisé pour le réservoir inférieur une cuve ancienne. La pompe Dumont et son installation ont coûté 970f.; avec des frais accessoires de 600f. La transformation a ainsi entraîné une dépense totale de 4915f.

Pour faciliter les manutentions dans l'usine agrandie nous venons de commander 2 autres wagonnets à 395f. Les wagonnets de l'ancien type au nombre de 5 seront réservés à la manutention des madriers.

Il résulte de la nouvelle organisation, économie—

1° de temps,
2° de main d'œuvre,
3° de matière

1° Il fallait avec l'ancien système, pour arriver à une imprégnation moyenne, laisser les paves dans la cuve 20 à 25 minutes, et l'on pouvait estimer que pour conduire 1,000 pavés de la scie aux piles avec passage au créosotage fallait 40 minutes

Dans le nouveau système il faut environ 30 minutes

2° On employait dans l'ancien système (les pavés étant amenés par des manœuvres) pour le créosotage, l'extraction, le roulage de la cuve aux piles et l'empilage cinq ouvriers

	Francs
On devait les payer en raison des sujétions de leur travail 0 80f de l heure, soit en 9 heures une dépense de	36
Le remplissage du bac ne pouvait être fait qu en dehors des heures de travail, et donnait lieu a 2½ d heures supplémentaires, soit	2
Le total de la main d œuvre revenait à . .	38
Aujourd hui le personnel a pu être réduit a 4 ouvriers il suffit de simples manœuvres Le salaire a été ramené par transaction à 0 70f et pourra être abaissé a 0 60 Le remplissage du réservoir se fait en cours de service La pompe n'absorbe que 0 50 ch (renvoi compris) et ce travail mécanique ne coûte pas par jour plus de . . .	0 45
Le prix de revient journalier de la main d œuvre revient ainsi à 25 6 f ou plutôt avec les salaires à 0 60f a . .	22 05
Soit une économie par jour de . . .	15 95
Ajoutons qu il sera possible, en raison du gain de temps de créosoter ou transporter 18 000 pavés par jour au lieu de 15,000 pavés soit un bénéfice de ⅕ en sus Pour la même quantité de 15 000 pavés le prix de revient correspondrait donc en main d'œuvre à	18 32
L'économie réelle monterait à	19 68

3°. *Matières.*—Des pesées faites avant et après impregnation il résulte que *sans pression* la quantité de créosote absorbée reste à peu près constante sur la moyenne des bois mis en œuvre, de 24 309 kilogrammes environ par mètre cube, même lorsque l'on prolonge l'immersion

	Francs
Dans le premier système, par suite des pertes la quantité d huile lourde consommée était portée par M^3, a 30^k 200, elle ne dépassera pas dans le second 2^k 000 au prix de 11f les % kilos il en revient par M^3 une économie de 0 92f et pour une production journalière de 15 000 pavés de . .	20 39
Sans parler de l avantage d une propreté remarquablement plus grande de l usine L'économie totale journalière, revient ainsi a environ	40 00

Avec la production de l'usine du dernier exercice (consommation d'environ 10,000 mètres cubes) l'économie annuelle sera d'environ 10,000 f.

Le prix de revient de créosotage avec le système actuel reviendra ainsi par mètre cube de bois à environ 3. 25 f. (ou par mètre carré de pavage 0. 45 f.) au lieu de 4. 25 f. (et par mètre carré 0. 60 f.).

L' INGÉNIEUR de la 3^{me} section.

Petsche.

APPENDIX IV.

Methods employed at the Laboratory of the "École des Ponts et Chaussées" Paris, for testing the suitability of various woods for the paving of streets.

Tests were employed to determine the following points:—

I The co-efficient of elasticity and breaking weight

II. Resistance to wear under friction

III Amount and effect of compression under various pressures.

IV. Amount of compression and wear under heavy blows, and ultimate effect.

V. Amount of expansion with imbibed water and expansive force exerted when the dilatation is partially prevented

I.—Determination of the Co-efficient of Elasticity and Breaking Weight.

The experiments were tried with bars 1·10 m long and 0·03 × 0·03 as nearly as possible rectangular section For each species three such bars were used, two of them dried in the water oven at 30° C. until further loss of weight ceased, the third after immersion for 5 days in water at 30° C. subsequent to drying like the first two.

The bars were placed on supports 1 metre apart and weighted in the middle with a constantly increasing load obtained by allowing a steady current of water to flow into a suspended bucket By a special arrangement the length of the normal of flexion was automatically registered on the scale of 50 to 1, and in this way the curvature was accurately measured for successive additions to the load. The co-efficient of elasticity E was thus obtained from the formula $E = \frac{P}{n} \times \frac{1}{4bh^3}$, in which P= the weight, n= the corresponding normal of curvature, and b and h= respectively the sides of the section of the bar expressed in metres.

The breaking weight was similarly obtained by continuing the inflow of water until rupture and measuring, by means of a special adaptation of verniers the normal of curvature under successive additions to the load.

The results of the measurements were tabulated in Forms I and II (which see at end). In order to obtain figures comparable with each other, the load necessary to break bars of square section of 10 centimetres side was worked out for each bar on the assumption that the resistance to bending and breaking varies directly as the width of the bar × the square of its height (in section of course).

In the case of some of the species the results varied in a marked manner according to the direction of the lines of boundary between the various concentric rings; hence a sketch of the section of each bar, indicating the lines of the concentric rings, was made opposite in the column of "Remarks".

Also, to render the figures in Form II comparable, the normals were worked out for bars having exactly a section of 3 centimetres × 3 centimetres.

The results recorded in Form II were also represented graphically by means of a curve, the abscissæ representing the loads (1 centimetre = 10 kilogs.) and the ordinates the normals of curvature (1 cent. = 5 mill. of normal).

II.—DETERMINATION OF HEIGHT WORN AWAY BY FRICTION.

For each species two prisms 12 centimetres high (the fibres running in this direction) by 6 centimetres × 4 centimetres, first oven dried at 30° C. until there was no further loss of weight, then immersed in water at 30° C. during 5 to 6 days.

In this state of imbibition the prisms were placed, standing upright, in a rotating cast-iron mill (Darry pattern). The pressure was regulated to 250 grammes per square centimetre, the mill being sprinkled over thickly with emery powder No. 3 moistened with just sufficient water (exactly determined by experiment) to form a sort of paste capable of constantly moving in front of the prisms, in the same way that the dry quartz sand employed in experiments with stone moves in front of this latter.

The two prisms in the case of each species were cut so that the lines of concentric rings of the one might be in the direction in which the mill moved, while those of the other lay in the normal to this direction.

After 2,000 turns of the mill (1,000 over each end of the prisms) corresponding to a linear run of 3,280 metres at a uniform rate of 2,000 revolutions in an hour, the amount worn away (loss of height) was measured and recorded in Form III, in which were entered also the respective densities of the prisms.

The experiment, however, showed that the amount worn away had little to do with the direction in which the lines of concentric rings were placed with respective to the movement of the mill, but, teak excepted, varied principally with the density. Thus, in the case of some of the species, a difference of 100 to 150 kilogs. in the weight of a cubic metre (= 6 to 9 lb in the weight of a cubic foot) resulted in a difference of 33, and even more, per cent. in the amount worn away—a circumstance that proves the necessity of experimenting separately with wood of minimum, mean and maximum densities.

III.—DETERMINATION OF RELATIVE BEHAVIOUR UNDER CRUSHING STRAINS.

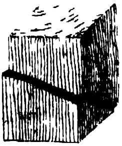
In these experiments rectangular prisms of square section, 8 centimetres side, and from 12 to 15 centimetres high, with perfectly parallel faces and fibres running in the direction of their length, were used. For each species there were 4 prisms 12 centimetres and 4 others 15 centimetres high, half of each group being oven-dried at 30° C.

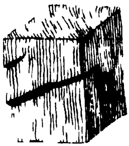
until all loss of weight ceased, the other half subjected, after similar preliminary desiccation, to prolonged submersion in water (70 days for six of the species, 17 days for iron wood, and 35 days for the rest). Even after 70 days' submersion the prisms were not saturated—a circumstance that points to the necessity of longer submersion in all the experiments, especially in the determinations under II and IV.

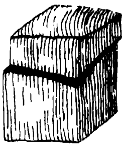
The prisms were placed, standing upright between the two plates of a hydraulic press and compressed until the fibres were forced apart and turned from their original direction (see sketches below); in other words, to the point of "crushing."

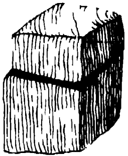
Hard and soft woods.

Soft woods saturated.


Dried


Saturated


During Compress^{n}


After Compress^{n}

Further increase of pressure could of course produce no further compression, but only had the effect of causing the upper separated piece or pieces to slip down along the plane or planes of fracture.

It was noticed that after crushing, the prisms were still able to bear without further compression, for a time at least, lighter pressures than that which produced the crushing; these pressures were ascertained and entered in columns 8 and 9 of Form IV.

During the experiments the amount of compression under different pressures was measured with special vernier scales.

A remarkable fact noticed was that the desiccated prisms retained finally the form they assumed at the moment of crushing, whereas those which had been saturated, and especially those which had absorbed a large quantity of water, recovered, at the end of some days, almost entirely their original form, without, however, acquiring again their original power of resistance to crushing strains.

The wet prisms suffered more compression than the dry ones. In both cases loss of height was due to sliding down, after rupture, of the upper portion on the lower, as well as to displacement and bending of all the fibres downwards before crushing; but whereas in the case of the dry prisms the second cause could act only to a very limited extent, in that of the wet prisms it was a very powerful factor, resulting in a very appreciable flattening out of the prisms.

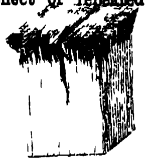
The results of all these experiments were recorded in accordance with Forms IV and V. Moreover, the results recorded in the latter form were represented graphically by means of a curve, the abscissæ representing the pressures (1 cent. = 50 kilogs.) and the ordinates the amount of compression (1 decimetre = 1 mill. of compression).

IV.—Determination of Effect under Shocks (Impact).

The experiments were tried with rectangular prisms of square section (sides = about 6 centimetres) and 12 and 15 centimetres high (in the direction of the fibres). For each species there were three prisms, two of them oven-dried at 30°C. till complete cessation of loss of weight, the third after immersion in water during several days subsequent to being oven-dried at 30°C.

For experiment the prisms were placed on a strong iron platform, each inside a strong square iron case 14 centimetres high and of 7 centimetres side, secured to the platform with bolts. The prisms being only 6 centimetres square, the interval between them and the sides of the cases were filled with rosin, poured in liquid, thus fixing the prisms firmly. In this manner the 15-centimetre prisms projected above the cases an entire centimetre. To place the 12-centimetre prisms in the same condition an iron plate 3 centimetres thick was placed under them. This free length of 1 centimetre reproduced more or less the conditions obtaining in a roadway after it has been under circulation for a little time.

The ram used weighed 20 kilogs. and the striking surface was 62 mill. square. In every case the distance through which it was dropped was 2 metres.



Under the effect of repeated blows the fibres of the prisms were more or less crushed, pushed away, and bent outwards (see sketch opposite). Some of the prisms which had already a few cracks before the experiment, or whose fibres were not quite parallel to the vertical faces, were split at the same time that they were crushed.

The ram, so long as no marked crushing or splitting had taken place, bounded back with force. From the moment crushing and splitting began, the rebound diminished at each successive stroke, becoming ultimately *nil*.

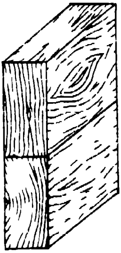
The amount of compression suffered was measured after the prisms were removed from the cases. As in the case of compression under pressure, so also here, the compression suffered by the dried prisms was less in degree but nearly permanent, whereas the wet prisms recovered to some extent by the subsequent straightening of the bent fibres. It is no doubt to this last circumstance that we must look for the explanation of the well-known woolliness of surface of roadways that are kept moist.

The results of the above experiments were recorded in accordance with Form VI, in which, in order to render comparison possible at a glance, there is a column in which the results are reduced to one and the same cross section for all the prisms, on the assumption that the degree of compression is directly as the original extent of surface brought under the ram.

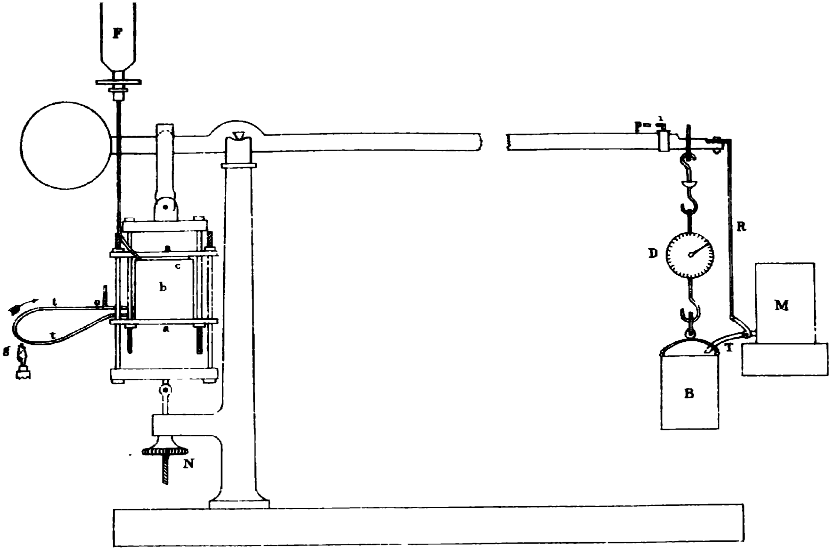
V.—DETERMINATION OF THE THRUSTS EXERTED BY PAVING BLOCKS DURING IMBIBITION OF WATER WHEN NOT ALLOWED TO EXPAND FREELY AND OF AMOUNT OF DILLATATION OF THE SAME BLOCKS UNDER PROLONGED IMMERSION WHEN ALLOWED TO EXPAND FREELY.

The experiments were tried with ordinary paving blocks 15 centimetres high by 17 × 8 centimetres, after the sides had been made as exactly parallel to one another as possible.

For the first determination it was necessary to devise an apparatus, such that, while the free expansion of the blocks was prevented in one direction at least, the amount of thrust exerted by the blocks in that direction could be exactly measured at every moment. This apparatus is figured on the next page and consists of a lever the arms of which are as 1:100, and a contrivance (A A) attached to, and working, the shorter arm of the lever.



The block or blocks are placed, fibres lying horizontally (see sketch opposite) in the box *b*, the sides of which are higher than the top of the block or blocks, as the case may be. An iron block *C* is then put over the wood, the whole being placed, as shown in the figure opposite, between the two iron plates *a*, *á*, the upper of which is prevented by the nut N from moving upwards, while the lower one can move downwards as the wood in the box expands and pushes up the piston-like block *C*, dragging down with itself the short arm of the lever. Through the funnel F the water in the box is always kept at the same level.



The apparatus on the short arm of the lever has, in order to show it better, been represented turned through an angle of 90°, the adjacent face being much narrower. The Thermo-Syphon *t* is really fixed on the broad face, but has been drawn as if attached to the narrow face in order to show more clearly the manner of its arrangement.

To the long arm of the lever are attached the following:—

(I) A bucket B, hanging from a dynamometer D, which itself is suspended directly from the lever.

(II) An iron rod R, which, as it is pulled up or pushed down by the lever, opens or shuts the tap T attached to the bottom of another bucket M containing mercury

(III) An index *i* which indicates horizontality when it is on a level with the fixed point *p*

The attachments of each arm of the lever are so adjusted that they are in exact equilibrium, the weight of the wood and water being taken into account.

To begin the operation, the indicator *i* is brought up on a level with *p* by means of the nut N, and the water is allowed to flow into the box

As water is absorbed the blocks of wood expand, dragging down the short arm of the lever and thus pulling up the long arm This opens the tap T and the mercury flows into the bucket B, until there is enough in the bucket to overcome the strain caused by the expansion of the wood The lever is then again in equilibrium and the tap T gets closed In this way to every little expansion of the wood on the short arm there is an instantaneous response in the shape of an outflow of mercury, equal in weight to the increased strain on the long arm, and the lever remains constantly horizontal

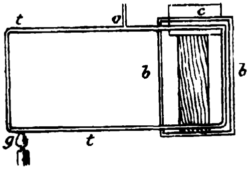
The dial of the dynamometer was read at fixed intervals of time and the readings recorded in Form VII.

In the apparatus just described the wood is prevented from expanding in only one direction It is possible that if the expansion on the other two opposite faces of the blocks were prevented, thus placing the blocks under the exact conditions which obtain in a roadway, the results would be different

The blocks were remeasured immediately they were taken out, to ascertain the amount of expansion in the direction in which expansion was unchecked, this expansion corresponded with the maximum force exerted by the expanding wood

In order to render all the results comparable, the blocks of wood were, just before the experiment, oven dried at 30° C and the water in the box was constantly maintained at the temperature of 30° C. with the aid of a thermo-syphon, thus devised

An endless copper tube *t* is fixed, as represented in the sketch opposite, inside and outside the box containing the paving blocks. There is an opening at *o*, where an open upright glass tube is attached, through which the copper tube is filled and which also serves as a safety valve. The tube is heated at *g*, and a constant current of warm water is thus established which circulates through the entire tube,



warming and keeping up to the required temperature the water in the box.

It is advisable to complete the above experiments by trying the same tests with blocks containing the average quantity of moisture found in new ones at the moment they are put into the road.

In order to measure the amount of free expansion, some of the blocks that had been used in the experiments described on the preceding page were left under water at 30° C. for a prolonged period. These blocks were then again oven-dried at 30° C. and measured to ascertain whether they would shrink back to their original size. These measurements were recorded separately in Form VIII.

N. B.—In order to show how the various Forms which follow are to be filled up, I have entered the figures for teak and iron wood in each of them. The teak experimented upon was from Java, the iron wood from Borneo.

Table I.—Co-efficients of Elasticity and Breaking Weights.

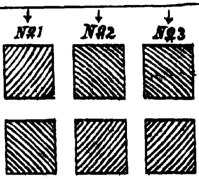
Table I —Co-efficients of

Species	Running number of bar	DIMENSIONS JUST BEFORE EXPERIMENT.		DENSITY		Percentage of contained water	Weight employed (P) Kilogrammes	Normal of curvature (n) in metres
		Width (b) in metres.	Height (h) in metres	Oven dried at 30° C	After absorbing water for 5 days			
Teak . .	1	0 0357	0 0352	0 672			19 800	0 002350
	2	0 0359	0 0363	0 716			19 290	0 001770
	3	0 0361	0 0368	0 709	0 748	2 9	18 600	0 001906
			mean	0 699	0 748			
Iron wood	1	0·0267	0 0273	1 066			12 095	0 002544
	2	0 0287	0 0269	1 036			11 9-0	0 002584
	3	0 0278	0 0267	1 063	1·077	1 4	9 650	0 002780
			mean	1 055	1 077			

Table II —Normals of curvature

Species	Running number of bar	NORMAL OF CURVATURE IN MILLIMETRES							
		20 Kilogrammes		40 Kilogrammes		60 Kilogrammes		80 Kilogrammes	
		Oven dried	Soaked	Oven dried	Soaked	Oven-dried	Soaked	Oven dried	Soaked
Teak . .	1	2 2 3 6		5 0 8·2				9 0 14 7	
	2	1·9 3 3		3 5 6 2				7 0 12 3	
	3		2 1 3·3		3·7 6·7		..	..	7 5 13 6
		Mean 3 45	3 5	7 2	6 7			13 5	13·6
Iron wood	1	4·2 3		6 4 6·2		12·6 9·3		17·2 12 8	
	2	4 3 3 3		3·6 6 6		12 9 9·9	..	17 6 13 6	
	3		5 8 4·2		11 6 8 4		17·7 12 8		24·2 17 5
		Mean 3 2	4 2	6 4	8 4	9 6	12·8	15·2	17 5

Elasticity and Breaking Weights.

CO-EFFICIENT OF ELASTICITY		BREAKING WEIGHT		BREAKING WEIGHT OF BARS SIMILAR TO THOSE TESTED, BUT HAVING A SQUARE SECTION OF 10 CENT × 10 CENT		REMARKS
Oven dried at 30° C	After soaking in water for 5 days	Oven-dried at 30° C	After soaking in water for 5 days.	Oven dried at 30° C	After soaking water for 5 days	
		Kilogrammes		Kilogrammes		
1 413 10g		300		6 649		
1 587 10g		350		7 460		
	1 350 10g		290		5 964	
1 500 10g	1 350 10g			7 055	5,964	
2 186 10g		200	..	9 723		
2 066 10g		190		8,726		
	1 633 10g	..	125		6,034	
2 126 10g	1 633 10g			9 225	6 094	

under successive loads

UNDER A TOTAL LOAD OF								REMARKS
100 Kilogrammes		130 Kilogrammes		160 Kilogrammes		200 Kilogramm		
Oven dried	Soaked	Oven dried	Soaked	Oven dried	Soaked	Oven dried.	Soaked.	
		14 0 22 9		19 5 31·9		24 5 40 1		The bars tested were the same as those entered in Table I the direction of the fibres during the experiments having been also the same
		11 0 19 3		14 5 25 4		1 80 30 5		
			11 5 20·9		15 5 28 2		20 5 30 2	
—	—	—	—	—	—	—	—	
		21 2	20·9	28 65	28 2	35 3	30·2	The figures to the left in each column are those which were actually read those to the right have been obtained by calculation for bars of perfectly square section with sides exactly equal to 3 centimetres.
=	—	=	=	=	=	=	=	
31·7 16 1		26·2 19 3		35 5 26 4				
22 6 17 4	.	27 4 20 8		36·8 28·0			..	
—	31·0 23 4		30 8 28 7					
—	—	—	—	—	—	—	—	
16·75	23 4	20·(	28 7	27 2				

Table III.—Test for Wear under Friction.

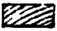
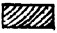
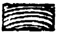
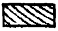
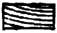
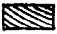
SPECIES	Running number of prisms.	DENSITY.		Percentage of volume of water absorbed in soaking	Amount of wear (loss of height) after 2 000 revolutions of the mill	Sketch shows lie of concentric rings on surface exposed to friction	REMARKS.
		Oven-dried.	Soaked				
					Centimetres.		
Teak . .	1	0 604	0 707	10·8	0·75		
	2	0·631	0·727	9 6	0 98		
	1	0 650	0 723	6·8	0 72		Supplementary teast owing to the great difference between 0 75 and 0·98 obtained in the first test.
	2	0 618	0 689	7 6	0 98		
	1	1 108	1 125	2·2	0 59		
	2	1 109	1 140	3 1	0 56		

Table IV—Test for Resistance to Crushing Strains

SPECIES.	Running number of prism	DENSITY		Percentage of volume of water absorbed during immersion.	Load per square centimetre producing the crushing for		Load per square centimetre of original surface under which there is for a time at least no further compression subsequent to rupture		REMARKS
		Oven dried	Soaked		Oven dried wood	Soaked wood	Oven dried wood	Soaked wood	
						Kilog	rammes		
TEAK	1	0·603			606		328		
	2	0 608			579		350		
	3	0 600	0 862	26 2		399		226	
	4	0 600	0 864	26 3		400		225	
Mean . .		0 603	0 863	26 3	590	400	339	226	
	1	0·719			750		394		
	2	0 711			808		501		
	3	0·716	0 928	21 2		450		218	
	4	0 715	0·930	21 5		453		269	
Mean . .		0 715	0 929	21 35	777	452	448	244	
General average .		0 659	0 896	23 9	684	426	393	235	
IRON WOOD	1	1 137			868		489		
	2	1 121			900		305		
	3	1 110	1 166	5 6		703		492	
	4	1 082	1·133	5 1		783		386	
Mean .		1 112	1·150	5 35	890	743	397	439	
	1	1 127			868		376		
	2	1 140			898		398		
	3	1 128	1 174	4 6		700		442	
	4	1 137	1 181	4 4		755		439	
Mean . .		1 133	1 178	4 5	883	727	387	441	
General average		1 123	1 164	4 95	886	735	392	440	

Table. V—Amount of Compression under Constantly Increasing Pressure.

Table V.—Amount of Compression

Species.	Prisms.		Amount of compression, measured in millimetres per square to									
			100 kilogs.		150 kilogs.		200 kilogs.		250 kilogs.		300 kilogs.	
	Height.	Running number.	Oven-dried.	Soaked.	Oven-dried.	Soaked.	Oven-dried.	Soaked.	Oven-dried.	Soaked.	Oven-dried.	Soaked.
Teak	0·12m	1 & 3 2 & 4	0·30 0·35	0·37 0·45	0·45 ...	0·45 ...	0·55 0·50	0·55 0·60	0·55 ...	0·65	0·57 0·60	0·75 0·90
	Mean .	.	0·33	0·41	...	...	0·53	0·58	...	...	0·59	0·83
	0·15m	1 & 3 2 & 4	0·15 9·20	0·40 0·45	0·30 ...	0·55 ...	0·37 0·35	0·55 0·70	0·40 ...	0·62	0·45 0·55	0·70 0·80
	Mean .	.	0·18	0·43	...	..	0·36	0·63	...	..	0·50	0·75
Iron wood . .	0·12m	1 & 3 2 & 4	0·25 0·20	0·25 0·15	0·35 ...	0·40 0·30	0 45 0·35	0·55 0·37	0·52	0·60 0·45	0·57 0·45	0·65 0·47
	Mean .	.	0·23	0·20	...	0·35	0·40	0·46	...	0·53	0·51	0·56
	0·15m	1 & 3 2 & 4	0·35 0·15	0·20 0·20	0·40 ...	0·30 0·30	0·47 0·35	0 35 0·40	0·55 ...	0·45 0 40	0·60 0·42	0·50 0·50
	Mean .	.	0·25	0·20	...	0·30	0·41	0 38	...	0·43	0·51	0·50

Table VI.—Results of

Species.	Prisms.		Section, in square centimetres, of prisms at beginning of experiment.	Density.		Percentage of water absorbed by the prisms.	Length of drop of ram in metres.	Number of blows after which loss of height (compression) became appreciable.	
	Height.	Running number.		Oven-dried.	Soaked.			Oven-dried.	Soaked.
Teak	0·12m	1 2 3	37·70 37·58 38·94	0·608 0 601 0·614	... .. 0 783	... ... 16·9	2 *Id.* *Id.*	16 10 ...	 7
		Aver	ages .	0·608	0·783	16·9		13	7
	0·15m	1 2 3	37·76 36·91 38·88	0 601 0·732 0·635	... ... 0·785	... ... 15·0	*Id.* *Id.* *Id.*	16 13	 7
		Aver	ages .	0·656	0·785	15·0		14·5	7
	General	aver	ages .	0·632	0·784	15 95		13·75	7
Iron wood . . .	0·12m	1 2 3	34 11 33·87 34·61	1 070 1·051 1·110	... 1·157	... ... 4·7	*Id.* *Id.* *Id.*	13 15 ...	 10
		Aver	ages .	1·077	1·157	4·7		14	10
	0·15m	1 2 3	33·93 35 23 35·23	1·123 1·084 1·121	... . . 1·141	... ... 3·0	*Id.* *Id.* *Id*	10 16 ...	 9
		Aver	ages .	1·109	1·141	3·0		13	9
	General	avera	ges .	1·093	1 149	3·85		13·5	9·5

under Constantly Increasing Pressure.

MILLIMETRES OF SURFACE UNDER THE FOLLOWING PRESSURES UP RUPTURE										REMARKS
400 kilogs.		500 kilogs		600 kilogs		700 kilogs		800 kilogs		
Over dried	Soaked	Oven-dried	Soaked	Oven dried.	Soaked	Oven-dried	Soaked.	Oven dried	Soaked	
0 70 0 75	1 55	0 95 1 15		1 65				..		
0 73		1 05								
0 60 0·62	0 92 1 00	0 75 0 67		0 95 0 77		1 20 0 92		1 10		
0 61	0 96	0 71		0 68		1 06				
0 73 0 57	0 97 0 55	0 87 0 67	0 85 0 65	0 95 0 75	0·95 0 80	0·97 0·85	1 05 0 92	1 05 0 97		
0 65	0 65	0 77	0 75	0 85	0 88	0 91	0·99	1 01		
0 67 0·47	0 60 0 60	0 82 0 55	0 65 (70	0 92 0 60	0 75 0 80	1 07 0 80	0 90 0 87	1 15 1 00		These four prisms have a much higher density than the other four of the same species
0 57	0 60	0 69	0 68	0 76	0 78	0 94	0 89	1 03		

Shock (Impact) Tests.

Total number of blows in entire experiment	WORK DONE BY RAM DURING ENTIRE TEST (REBOUND OF COURSE OMITTED) IN METRE KILOGRAMMES (=7 22 FOOT POUNDS)		AMOUNT OF COMPRESSION SUFFERED ON CONCLUSION OF TEST MEASURED IN MILLIMETRES		AMOUNT OF COMPRESSION FOR THE SAME NUMBER OF BLOWS CALCULATED FOR A SECTION OF 136 SQUARE CENTIMETRES.		REMARKS
	Oven-dried	Soaked	Oven-dried	Soaked	Oven dried	Soaked	
20	800		3 2		3 4		
20	800		5 3		5 5		Split at tenth blow
10		400		2 5		2 7	
					4 45	2 7	
20	800		3 7		3 9		
20	600		4 3		4 4		Split at sixth blow
10		400		1 5		1 7	
					4 15	1 7	
					4 3	2·2	
17	680		1 9		1 8		
20	600		1 5		1·4		Owing to some previous injury to this prism only 17 blows could be given.
10		400		0 8		0 8	
					1 6	0 8	
20	800		5 0		4 7	..	Cracked before test. Crack widened at 10th below, a splinter being detached
20	800				1 7		
10		400		0·8		0·8	
					3·2	0·8	
					2·4	0·8	

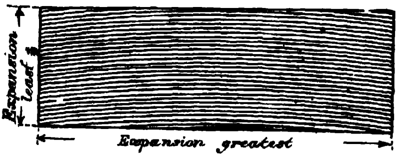
Table VII.—Thrust exerted by paving blocks while absorbing

SPECIES.	Number of blocks tested together.	DIMENSIONS OF THE BLOCKS TESTED.				Density of the blocks oven-dried.	Weight in grammes of water absorbed during entire test.	FORCE OF THRUST IN					
		Height.	Length.	WIDTH				3	6	9	12	24	36
				Before	After								
				Test.									
		Millimetres.						Hours.					
Teak.	1	161·8	149·9	80·5	81·7	0·710	202	33	58	74	99	142	179
	1	160·1	149·6	80·0	81·8	0·698	229	42	81	115	146	212	263
						Ave	rages .	37	69	94	117	177	221
	2	158·7	149·8	80·5	81·6	0·686	253	109	154	188	216	306	363
		159·9	149·7	80·3	81·7	0·698	257						
				Aver	age .	0·694							
Iron wood .	1	159·0	149·9	79·5	80·0	1·138	100	32	48	57	64	80	92

Table VIII.—Expansion, in millimetres, of paving

PARTICULARS.		SPE				
		Teak.	Iron-wood.			
Height .	Before test, oven-dried	159·9	160·0			
	After prolonged immersion	162 5	170·0			
	" re-drying	160·0				
	Percentage of permanent expansion . .	1·6	0·5			
Length .	Before as well as after test (after being re-dried	149·7	149·9			
Width .	Before test, oven-dried	80·2	79·5			
	After prolonged immersion	81·9	80·0			
	" re-drying	80·4	..			
	Residual extension, per cent.	2·1	0·6			
Density .	Before test, oven-dried	0·698	1·135			
	After prolonged immersion	0·840	1·176			
Percentage of volume of water contained after prolonged immersion		14·2	3·6			

In the case of all the blocks it was noticed that expansion was greatest in the direction of



water, free expansion being prevented parallel to line of thrust.

KILOGRAMMES AT THE END OF														Remarks.
2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Days														
210	260	300	335	360	380	400	413	427						
311	377	420	460	500	540	570	590	600						
260	318	360	396	430	460	480	501	513						
439	543	635	710	770	822	872	920	965	1,000	1 040	1 080	1,118	1,143	
100	112	120	128	135	140	144	148	151	153	155				

blocks after prolonged submersion in water.

CIES						Remarks
						The period of immersion was for teak and iron ,wood 30 days. The difference in length before and after test (re-dried) was inappreciable The residual expansion in every case is almost a negligible quantity, and is probably entirely due to the formation of small fissures consequent on rapid drying.

the lines of concentric rings than in the normal to that direction (see sketch below)

APPENDIX V

NOTE SUR LES ESSAIS DE LABORATOIRE DES BOIS DESTINÉS AU PAVAGE.

L'étude des bois destinés au pavage ne paraît pas avoir été avant 1894 entreprise méthodiquement.

Les essais effectués en 1894 au Laboratoire de l'École des Ponts et Chaussées ont démontré l'extrême influence de l'humidité sur les conditions de résistance des bois, suivant que le bois est sec (étuvé à 30° jusqu'à cessation de perte du poids) ou imbibé.

Les modules d'élasticité et les charges de rupture par flexion diminuent du ¼, du ⅓, presque de la ½ pour certains bois, la résistance à l'écrasement pour les bois tendres diminue de plus de la moitié, tandis que les affaissements font plus que doubler. Le bois humide, par contre, sous le choc s'affaisse moins que le bois desséché, bien que l'affaissement soit sensible sous un nombre inférieur de coups. Les poussées exercées par les bois mouillés, leurs dilatations, les densités dépendent naturellement de la quantité d'eau primitivement contenue. Il est donc essentiel, pour comparer des bois, de tenir compte de cet état d'humidité, et les résultats qui ont été fournis jusqu'ici dans divers essais de laboratoire, ou qui sont cités dans divers ouvrages, sont viciés ou douteux par le seul fait que l'état d'humidité des bois n'a pas été défini.

Il convient donc de ramener les bois à des états autant que possible analogues :—

1°. La désiccation par l'étuvage à 30° jusqu'à cessation de perte de poids. Cette température paraît convenable, en ce sens qu'elle se rapproche des conditions de désiccation de la pratique et qu'elle n'altère point la structure et la composition du bois d'imbibition [1]

2° L'imbibition peut être réalisée par immersion soit pendant un même temps déterminé, soit jusqu'à saturation, si on a le temps ; l'imbibition n'arrive, en effet, à être absolûment complète qu'au bout d'un temps assez long, pouvant aller jusqu'à 2 et 3 mois, et variable suivant les essences.[2]

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[1] Les bois perdent toute leur eau vers 130° ou 140° C., à une température plus élevée, ils commencent à se décomposer ; ils perdent par évaporation naturelle et lente l'eau libre et arrivent ainsi à l'état de désiccation dite complète, mais conservent alors encore l'eau hygrométrique, 15 à 17% du bois dit desséché

[2] L'absorption est cependant à peu près complète au bout de 15 jours et le maximum est atteint au bout d'un mois ou peu s'en faut.

	15 premiers jours	15 suivants	15 suivants
	K	K	K
Un pavé des Landes gemmé créosoté environ 8×22 centimètres pesant 1kgr 809 gagne dans les .	0,267	0,069	0 008
8 × 22 non gemmé ,, 1k 182 .	0,228	0,063	0,020
,, pitch pin ,, 1k 348 .	0,236	0,081	
,, jarrah ,, 1k 864	0,221	0,073	0,005
,, karri ,, 2k 257 . . .	0,134	0,024	0,030
,, liem ,, 2k 290 . . .	0,162	0,021	0,006
(6 × 16) teak ,, 1k 043 . .	0,208	0 026	0,002
,, sapin Vosges (pied) 1k 841 . .	0,239	0,103	0,018
,, ,, Jura (pied) 1k 258 . . .	0,273	0,027	0,008
,, ,, do. (cime) 1k. 059	0,394	0,042	0,020

Ces pavés avaient été pris comme ils se trouvaient au dépôt et non desséchés

On obtiendra ainsi du bois dans des conditions extrêmes qui différeront sans doute toutes deux des conditions ordinaires de la pratique, notamment en ce qui concerne le pavage en bois, mais on en pourra tirer en général des conclusions pour les positions intermédiaires, surtout si les classements des positions extrêmes sont concordants, ou si l'écart entre les résultats extrêmes est faible.

Divers éléments sont à étudier pour apprécier la qualité de bois pour pavages —

1° Résistance à l'usure, qui est un facteur de l'élasticité et des résistances à l'écrasement, au frottement, à la percussion ,

2° Dilatations et poussées sous l'influence de l'humidité ,

3° Résistance à la pourriture.

Cette dernière ne se prête point aux essais physiques de laboratoire et a dû être laissée de côté

ÉLASTICITÉ

L'élasticité du bois doit jouer un certain rôle dans sa résistance à l'usure

Les bois soutiennent d'autant mieux le choc qu'ils sont plus élastiques et plus résistants

Le travail du choc est transmis en partie à la fondation, en partie au véhicule choquant qui rebondit , le reste est absorbé par le bois qui subit une déformation dont le caractère et la permanence varient d'après son élasticité Dans une chaussée ces phénomènes s'accentuent d'autant plus que la surface est devenue plus inégale, et ils prennent pour un revêtement fâcheux une réelle importance.

La réaction sur le corps choquant n'a pas encore été étudiée au Laboratoire de l'École des Ponts et Chaussées , elle pourrait l'être et aurait un certain intérêt

Les essais à la flexion ont donné une indication de l'élasticité des divers bois et ont fourni les classifications suivantes

Modules d'élasticité

(1)	Bois secs Decigrammes		Bois imbibés Décigrammes		Quantité d'eau absorbee °/	Observations.
Bois de fer de Bornéo .	1	2,126	1	1,683	1,4	
Liem du Tonkin . .	3	1,761	3	1,624	3	
Karri } (Australie)	2	1,933	2	1,628	2,8	
Jarrah } (Australie) .	4	1,715	9	0,809*	10,8	* Trop faible densité de l échantillon
Pitch-pin (Floride) .	5	1,510	5	1,224	9	
Teak de Java . .	6	1,500	4	1,350	2,9	
Pin des Landes gemmé	8	1,228	8	0,979	14	
Do do non gemmé	7	1,458	7	1,045	19	
Pin rouge du Nord .	9	1,210	10	0,783	18,8	
Épicéa du Jura, pied	10	1,003	11	0,668	18,7	† Anomalie, bois très dense.
Do. do., cime	11	0,843	6	1,153†	20·1	

(1) Bois classés dans l'ordre de densité

La classification à l'état sec suit l'ordre des densités sauf pour les pins gemmés et non gemmés.

On savait déjà que le gemmage réduisait l'élasticité et que, par une préoccupation peut être excessive, le bois gemmé n'était pas admis pour les poteaux des télégraphes et des usines.

Sauf certaines anomalies dûes aux densités anormales de certains échantillons, la classification reste à peu près la même pour les bois imbibés, mais les modules diminuent très sensiblement. Il est à noter combien le liem est peu impressionné par l'imbibition.

Les échantillons qui ont été mis *le même temps* dans l'eau ont absorbé des quantités très variables d'eau, et ce sont les bois qui ont les modules les plus élevés à l'état sec qui ont en général absorbé le moins ; il y avait une double raison pour que leur module se maintint élevé à l'état mouillé

USURE PAR FROTTEMENT

Les essais d'usure par frottement donnent des indications plus intéressantes pour la résistance des pavages en bois, bien que le frottement ne soit point la cause la plus importante de destruction

Les essais faits sur des bois desséchés, puis imbibés pendant 5 ou 6 jours (¹) fournissent la classification suivante .

		Mill^{m}		
Fer	3	5 7 et 5	pour 2,000	tours de meule
Liem	2	5 1 et 5	,	„
Karri	1	4 5 et 5	,	„
Jarrah	5	6 5	,	
Pitch pin	4	5 8 et 5	„	,
Teak	7	8 5	,	,
Pin gemmé	6	8 2	„	„
Pin non gemmé	11	11 1 et 5	„	,
Pin du Nord	8	8 9 et 5	„	,
Épicéa du Jura, pied	9	9 7	„	„
Do do, cime	10	10 1	„	„

La direction des couches du bois influe peu sur les résultats pratiquement et dans une chaussée les pavés présenteraient toutes les orientations de couches possibles. Des tares dans le bois, des variations importantes de densité peuvent entraîner des modifications très-importantes dans les résultats. Des pitch-pins de faible densité (642), donnaient une usure de $7^{mm}0$ environ, à la densité 739, $6^{mm}2$, 787, $5^{mm}5$, du jarrah de densité 772 donne 11^{mm}, de 894 $6^{mm}5$.

Des fentes, des fibres contournées font varier l'usure du simple au double.

On peut en déduire l'extrême importance du choix des bois réguliers, de densité s'écartant aussi peu que possible de la moyenne. Pour une même essence, la résistance croit avec la densité.

ÉCRASEMENT

Les essais ont porté sur des bois secs et sur des bois imbibés par immersion prolongée taillés en prismes de 0, 12 et de 0, 15 de haut cette différence de hauteur ne paraît pas exercer d'influence appréciable, et

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[1] Les essais de M Salle ont montré que le bois s use plus a l état humide qu'à l'état sec et l usure arrive ainsi à plus que double

la réduction de la queue des pavés ne doit point avoir d'inconvénients à ce point de vue.

Le classement suivant peut être établi :—

Essences	Charge en kilogrammes par centimètre carré.			
	Bois sec.		Bois imbibé.	
For	2	886	1	735
Liem	1	935	2	706
Karri	5	659	5	378
Jarrah	6	553	6	330·5
Pitch-pin	3	709	4	386
Teak	4	684	3	426
Pin des Landes gemmé	7	581	7	280
Do non gemmé	8	507	8	215
Pin du Nord	11	418	9	197
Épicéa du Jura, pied	9	470	11	166
Do do, cime	10	452	10	169

Sauf pour le bois de fer et le liem, l'humidité réduit d'une manière très importante (du $\frac{1}{3}$ à plus de la $\frac{1}{2}$) la résistance.

Dans la pratique on reste loin des charges d'écrasement, les charges du gros camionnage correspondent au plus à 15^{kgs} par cm^2 de surface portant des roues, elles n'arrivent à être doublées que dans des cas exceptionnels.

Les affaissements, même sous les charges lourdes, sont peu importants et moindres qu'on ne l'imagine : pour la charge de 100^{ks}, la plus voisine de la pratique, ils varient en général entre $0^{mm}2$ et $0^{mm}4$; ils peuvent doubler, tripler et quadrupler sous l'influence de l'imbibition. Ce caractère n'a point grande importance dans la pratique croyons-nous.

Noue noterons plutôt ce fait que les affaissements des bois humides (en particulier des bois tendres) persistent moins, la charge enlevée, et que pendant la charge les fibres s'infléchissent en augmentant la section : il peut en résulter une certaine désorganisation des joints du pavage.

CHOC.

Le choc est un des éléments de destruction les plus importants du pavage en bois. Tout d'abord la percussion du pied du cheval entre en ligne, et son action apparaît nettement dans les rampes, les voies de tramways, les stations d'omnibus ; cette percussion est plus fréquente et plus vive aux allures de vitesse, et l'on peut constater que les chaussées à circulation même légère, mais rapide, fatiguent plus que celles soumises à la circulation lente de lourdes charges. A cette action s'ajoute celle du choc des véhicules qui se fait sentir d'autant plus que la chaussée est devenue plus inégale et plus cahotante ; elle est plus marquée dans les chaussées à joints larges que dans celles à joints serrés.

Les essais de ce choc, bien qu'il soit difficile de les effectuer dans les conditions mêmes de la pratique, sont donc, selon nous, particulièrement intéressants Ceux effectués au Laboratoire des Ponts et Chaussées se sont approchés autant que possible de ces conditions et ont reproduit les phénomènes d'écrasemet et de courbure des fibres qu'on observe dans les pavés extraits des chaussées

L'affaissement est beaucoup plus rapidement obtenu et beaucoup plus important que l'écrasement, il est beaucoup plus *vite* sensible pour les bois imbibés que pour les bois secs, mais disparait en partie, tandis que pour les autres il reste presque entièrement acquis et l'affaissement final est aussi moins fort

Les phénomènes de fente et de rupture en éclats qui se produisent aux essais sur les bois durs ne paraissent pas se realiser dans la pratique

Le classement suivant peut être établi

Essences	Affaissement m/m pour un même nombre de coups				Nombre de coups à partir desquels l'affaissement est sensible			
	Bois secs		Bois imbibés		Bois secs		Bois imbibés	
Fer	1	2 4	1	0 8	3	13 5	2	9 5
Liem	2	3	2	1 2	1	14 75	1	10
Karri	3	4	5	3 1	4	13	4	7
Jarrah	6	5	4	3 05	5	9 75	5	6 5
Pitch pin	5	4 7	6	3 6	6	9 25	6	6 5
Teak	4	4 8	3	2 4	2	13 75	3	7
Pin des Landes gemmé	7	6 65	8	4 4	7	8 25	7	5
Do non gemmé	9	8 6	10	4 9	8	5 75	8	4
Pin du Nord	8	9 8	11	7	10	4 75	11	1 5
Épicéa du Jura, pied	11	9 5	7	3 95	9	5	9	4
Do do, cime	10	8 5	9	4 8	11	4 25	10	3 5

DENSITÉ

Au cours des divers essais on a eu occasion de mesurer les densités des bois, les écarts entre les limites extrêmes sont asses variables suivant les essences et peuvent se resumer ci-apres —

Essences	Minimum	Maximum	Bois desséchés Moyenne	Écart maximum	Classement
Fer	1 036	1,140	1 101	104	3
Liem	852	1,037	950	185	8
Karri	831	1,000	943	169	7
Jarrah	732	934	855	202	10
Pitch-pin	642	1 020	778	378	11
Teak	600	732	662	132	5
Landes gemmé	578	709	650	131	4
Do non gemmé	528	659	578	136	6
Nord	411	609	487	198	9
Jura, pied	380	475	422	95	2
Do, cime	374	441	398	67	1

La densité influe sur les résistances à l'écrasement et au choc

L'égale usure d'un pavage en bois et son homogénéité sont des qualités essentielles. La constance de densité est une qualité de première importance et il y a lieu de tenir grand compte du classement qui précède. Il est à noter en particulier combien le pitch-pin, qui présente cependant des qualités de premier ordre, a des densités variables, et l'on trouve là l'explication de certains insuccès qui ont pu paraître étrangers Il en est encore ainsi, bien que dans une mesure moindre, du jarrah et du bois du Nord.

Les échantillons de bois du Jura, cime et pied, avaient des densités qui se mélaient, et l'on s'explique que les resistances aux divers essais mécaniques soient peu differenciés.

Poussées.

La poussée du bois est parfois fort génante (voies de Tramways et bordures) et il est interesssant d'examiner les bois à ce point de vue

Les bois durs et les bois tendres se comportent diversement quand ils sont soumis à l'action de l'immersion .—

Essences	Poussées au bout de						Maximum de poussée au bout de	
	3 heures		2 jours		5 jours			
		Kilogs		Kilogs		Kilogs	Kilogs	jours
Fer .	1	32	1	100	1	128	155	12
Liem . .	2	41	2	172	2	237	269	8
Kair . .	4	45	3	249	3	318	733	14
Jarrah	6	73	6	381	8	716	1,116	11
Pitch-pin . .	7	115	8	513	9	773	967	9
Teak . . .	3	37	4	260	4	396	513	10
Pin des Landes gemmé	8	224	10	619	11	878	990	10
Do non-gemmé .	9	337	7	477	5	568	527	8
Pin du Nord .	5	67	5	334	6	448	455	6
Épicéa Jura, pied .	10	148	9	525	7	565	565	5
Do do, cime .	11	372	11	812	10	848	848	5

Les bois durs qui s'imbibent plus lentement que les bois tendres donnent au début des poussées moindres, leur maximum de poussée est atteint au bout de plus de temps et est en général supérieur au maximum de poussée des bois tendres.

Le bois de fer et le liem surtout, et aussi le teak, exercent des poussées très-faibles et absorbent peu d'eau. Le jarrah et le pitch-pin, bien qu'absorbant des quantités limitées d'eau, poussaient extrêmement ; de même le gemmé, malgré une absorption moindre que le non-gemmé, exerce une poussée beaucoup plus vive. Le phénomène est curieux et ne serait sans doute expliqué que par un examen microscopique de la texture du bois.

L'imbibition sur la voie publique[1] se fait d'une manière différente ; puisqu'elle ne s'opère que par une face du pavé, et par l'extrémité des fibres souvent protégées par une couche de gravillon. Des essais qui précèdent, il n'en résulte pas moins des indications intéressantes qui expliquent la diversité des phénomènes de poussée suivant les essences des bois et la durée de la cause d'humidité, et font ressortir l'importance de ces poussées qui pour un pavé complètement imbibé peuvent atteindre près d'une tonne Les pavés rassemblés dans une chaussée pousseront moins à cause de l'elasticité des joints,[2] mais on n'en conçoit pas moins combien il est difficile de s'opposer au renversement des bordures et des voies de Tramways

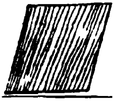
Ces poussées peuvent être attenuées par l'établissement des joints de rive maintenus meubles et l'enlèvement en temps utile de partie des rangés bordant ces joints.

DILATATIONS

Il est donc interessant d'étudier la dilatation linéaire des bois sous l'influence de l'humidité

Les essais sur des pavés imbibés à saturation ont montré que la dilatation dans le sens des fibres est insensible, qu'elle est plus forte suivant les dimensions de la section, en atteignant son maximum dans le sens tangent aux couches annuelles On s'explique ainsi que des pavés à fibres inclinées (fig. 1) poussent moins que les pavés à fibres droites, et aussi que dans une chaussée ordinaire, la poussée dans le sens longitudinal (coupe d'ailleurs par les joints) soit moindre que dans le sens tranversal, la majorite des pavés présentant les lignes de leurs couches parallèles à cette derniere direction Ce sont encore les bois de fer, le liem et le teak

Fig. 1



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[1] Des essais ultérieurs ont montré que les pavés extraits de la voie publique étaient imbibés jusqu'a saturation et que le Karri et le Liem contenaient beaucoup plus d'eau qu'ils n'en avaient absorbé dans les essais de Laboratoire

Les garnitions de poids constatées au dépôt pour des paves empilés dans la cour, comparées a la variation des pavés empilés sous les hangars donnent une idée de la quantité d'eau que les pavés peuvent recevoir par suite des intempéries

	Pavés créosotés empilés dans la cour			Sous les Hangars		
	Gemmés.		Non Gemmés		Gemmés	Non Gemmés
	Grammes		Grammes		Grammes	Grammes
Decembre .	7 750	Ecart maxim, 0 530 gr	8 850	Ecart maxim 0 370 gr	7 680	8 170
Janvier .	8 040		8 610		7 660	8 175
Février .	8 225		8 730		7 600	8 170
Mars .	8 280		8 720		7 580	8 130
Juin .	7·945		8 330		7 280	7 815
Août .	7 535		8 165		7 195	7 750

La dimension en long de 22cm avec le maximum d'humidité s'est accrue de 3cm les pavés placés sous le hangar, bien qu'ayant décru de poids, se sont également dilatés, mais dans des conditions plus capricieuses.

[2] Les essais de poussée faits sur 2 pavés accolés, immergés ont donné des pousées très-inférieures au double de la poussée d'un pavé seul.

qui présentent les dilatations minima, 0 5 et 0·6 % et 1·6 et 2·1 %, tandis que les autres bois donnent des dilatations doubles et triples (1) et (2).

Moyenne des dilatations dans le sens transverral et longitudinal %			Quantité d eau absorbée %	
Fer	1	0 55	1	3 8
Liem	2	1 3	3	9·2
Karri	10	5 15	2	5 6
Jarrah	8	4 5	6	20·6
Pitch pin	11	5 3	4	10 9
Teak	3	1 85	5	14·2
Pin gemmé	4	3 6	7	26 3
Do non-gemmé	9	4 7	11	40·3
Do du Nord	6	4 3	10	33 8
Epicéa du Jura, pied	7	4 4	9	33·7
Do. do, cime	5	4 15	8	24

[1] Les essais de M Salle qui se rapprochent d'avantage des conditions de la pratique donnent 2 % au bout de 2 jours pour des pavés desséchés d abord, puis mouillés constamment par un filet d eau

[2] M Lave a trouvé pour des bois bien desséchés imbibés à saturation—

	Dilatation linéaire pour 100 sur la dimension		
	longitudinale	radiale	périphérique
Acacia	0 035	3 84	8 52
Hêtre blanc	0 400	6 66	10 90
Cèdre	0 017	1 30	3 38
Ebène	0·01	2 13	4 07
Chêne jeune	0 400	3 90	7 55
Chêne vieux	0 130	3 13	7 78
Sapin	0 076	2 41	6 18

Le tableau ci-contre dans les proportions généralement admises pour la proportion d eau totale contenue dans les bois En tranchant 17 % de la colonne B pour tenir compte de l'eau hygrométrique on aura la proportion d'eau libre

	% du poids total.	% du poids bois sec.
	A	B
Charme	18·6	22·8
Frêne	28 7	40·2
Chêne rouvre	34 7	53 1
Sapin (Abies)	37 1	58 9
Pin sylvestre	39 7	65 8
Hêtre	39·7	65·8
Orme	44 5	80 1
Sapin rouge (Picea)	45·2	82·5
Mélèze	48·6	94·5
Peuplier blanc	50 6	102 5

Les dilatations, comme les poussées, ne paraissent point dépendre (sauf pour le bois de fer, le liem et le teak) des quantités d'eau absorbées et tels bois qui, comme le karri et le pitch-pin, absorbent peu se dilatent extrêmement ; les bois ne se classent point dans le même ordre pour les dilatations que pour les poussées.

La facilité d'absorption de l'eau a son intérêt au point de vue de l'hygiène et de la conservation du bois, et un bois aura des chances d'être d'autant plus sain et durable qu'il s'imbibera moins facilement des liquides éminemment putrescibles de la voie publique. Ces essais sont à compléter, et le Laboratoire s'en occupe, par l'examen du degré d'humidité des pavés recueillis sur la voie publique et de leur contraction après dessication.

Les indications qu'on obtiendra ainsi définiront mieux les conditions de la pratique, et en réalisant artificiellement par une immersion ou un arrosage d'une durée convenable un degré analogue d'humidité, on pourra faire porter les essais de résistance sur des bois se rapprochant de ceux des chaussées.

CONCLUSIONS.

Quoiqu'il en soit, les essais qui ont déjà été faits permettent déjà des comparaisons intéressantes entre les divers bois.

Le tableau ci-dessous résume les classements obtenus dans les essais qui sont le plus probants pour la bonne tenue d'un pavage en bois :—

Bois.	Densités.	Écart des densités obtenues	Usure par frottement sec.	Écrasement		Choc		Poussée		Dilatation	Quantité d'eau absorbée	Totaux	Classement général moyen
				Sec	Imbibé	Sec	Imbibé	3 heures	3 jours				
Fer . . .	1	3	8	2	1	1	1	1	1	1	1	16	1
Liem	2	8	2	1	2	2	2	2	2	2	3	29	2
Karri . . .	3	7	1	5	5	3	5	4	3	10	2	48	4
Jarrah . .	4	10	5	6	6	6	4	6	6	8	6	67	5
Pitch pin . .	5	11	4	3	4	5	6	7	8	11	4	68	6
Teak . . .	6	5	7	4	3	4	3	3	4	3	5	47	3
Landes, gemmé .	7	4	6	7	7	7	8	8	10	4	7	75	7
Do. non-gemmé	8	6	11	8	8	9	10	9	7	9	11	96	10
Nord . . .	9	9	8	11	9	8	11	5	5	6	10	91	8
Jura, pied . .	10	1	9	9	11	11	7	10	9	7	9	98	9
Do. cime . .	11	2	10	10	10	10	9	11	11	5	8	97	11

Ce tableau fournit un classement moyen qui coincide à peu près avec l'ordre des densités (sauf pour le teak), il donne une supériorité très marquée dans tous les essais, d'abord au bois de fer, puis au liem, au teak, et enfin au karri Ce dernier bois, bien que très analogue de couleur et d'aspect et de même provenance que le jarrah, lui est nettement supérieur Le jarrah et le pitch-pin viennent ensuite, avec l'un et l'autre de graves inconvénients (surtout pour le pitch-pin) d'avoir des densités très variables)

La catégorie des bois durs se termine là.

Le bois gemme des Landes tient la tête des bois tendres et cela très nettement il est dans tous les essais de résistance très supérieur au bois du Nord et ne lui est inférieur que pour les poussées, caractère en somme secondaire Il vaut beaucoup mieux que le non-gemmé, qui peut être assimilé au bois du Nord Le bois du Jura n'a pour lui que sa constance de densité, mais il résiste mal aux causes d'usure, il doit venir, en somme, le dernier dans la classification

Il va de soi que ces conclusions, cependant assez nettes auraient une valeur bien plus grande si elles étaient appuyées sur *un nombre très considérable d'essais*

Ces resultats du laboratoire confirment-ils ceux de l'expérience pratique ?

On a malheureusement au début dans les pavages exécuté peu de zônes d'essais comparatives, et ce n'est guere que depuis 2 ans que nous nous sommes efforcés de placer dans diverses rues des bandes de bois d'essences diverses posées dans des conditions de fatigue autant que possible identiques

Les usures sont très lentes et c'est à peine si les sondages de 1895 donneront quelques premières indications

Nous ne pouvons donc citer que les quelques exemples suivants

Dans King's Road, à Londres, pour une circulation ramenée à l'unité de 1,000 tonnes par mètre de large l'usure annuelle a été pitch-pin, 0 0036, Sapin du Nord, 0 0006; c'est à peu près le rapport fourni par les essais de résistance mécaniques du Laboratoire

Dans le Strand, en voie courante, en 4 ans, le sapin du Nord a perdu 6 à 9^{cm}, le jarrah, 2^{cm} 5, à la station d'omnibus de Charing Cross le sapin du Nord a duré 1 an et perdu 11^{cm}, le jarrah a duré 3 ans et perdu 5^{cm} 7, à Fulham, en 3½ ans, le jarrah a pris 1 à 2^{cm} de saillie sur le sapin voisin. Faubourg Montmartre (carrefour La Fayette), en 27 mois, le jarrah a perdu 0.008, le gemmé 0 0128, soit par an 0.00355 et 0.00546, la supériorité accusee par les essais est très confirmée.

Celle du karri sur le jarrah l'est aussi, elle a été constatée à Londres Dans King's Road, en 4½ ans, le karri s'est usé de 6 $^{m}/_{m}$ de moins que le jarrah, celui-ci de 18 $^{m}/_{m}$ de moins que le sapin.

À Paris, rue La Fayette, en 8 mois, on trouve pour le karri 0^{mm} 7 et 1 $^{m}/_{m}$ 2, d'usure, pour le jarrah, 0^{mm}8 et 1^{mm}8 Au guichet de Rohan, en 7½ mois, le karri perd sur les frayés des roues 7 $^{m}/_{m}$, sur l'axe 0, le jarrah, 15 $^{m}/_{m}$ et 1 $^{m}/_{m}$; en 8 mois, dans un autre guichet, le chêne a perdu 6 m/m aux frayés et 8 m/m sur l'axe. Le pin des Landes usait de 61 m/m en 5 mois dans les caniveaux.

La supériorité du pin des Landes, même non gemmé, sur les pins des Cévennes a été marquée. Rue des Saussaies, en 4 ans, le non-gemmé présente une usure 0.008, pin des Cévennes 0.01, épicea des Cévennes, 0.015.

Boulevard Bonne Nouvelle, en 4 ans, le pitch-pin a perdu 20 m/m, le gemmé, 22..

Rue de Châteaudun (Ligne des Tramways), entre les rues La Fayette et le Faubourg Montmartre, les frayés des Omnibus à 3 chevaux se sont accusés très-fortement en moins de six mois sur le bois du Jura, d'une manière encore très-marquée sur le bois des Vosges,[1] et le bois du Nord (un peu moins) ; ils commencent à peine à apparaître sur le bois des Landes gemmé.

Dans les voies autour de l'École Centrale, le bois des Vosges et celui des Landes ont aussi apparu à peu près équivalents.

Ailleurs on a, il est vrai, constaté (Rue Jacob, Boulevard des Batignolles) une supériorité du sapin du Nord sur le bois des Landes, mais l'origine de ce dernier et sa nature, gemmé ou non-gemmé, est peu déterminée.

D'une manière générale, les résultats de la pratique paraissent concorder avec ceux du Laboratoire.

Il parait donc intéressant de poursuivre les récherches de laboratoire et en les multipliant, de les appliquer aux diverses essences susceptibles d'emploi.

Elles devront porter surtout sur les densités et sur les résistances au frottement, à l'écrasement, à la percussion avec des bois secs ou avec des bois *traités ou non* par des *liquides antiseptiques*,[2] en les plaçant dans des conditions d'humidité se rapprochant de celles de la pratique. Il serait intéressant également de déterminer la facilité du polissage du bois, le glissement étant un inconvénient à redouter des bois durs.

Les essais seraient à étendre à des pavés extraits des chaussées, revêtus de leur couche de gravillon et dans leur état naturel d'humidité.

Il conviendra d'autre part, et nous nous en préoccupons, de compléter cette étude par un examen microscopique et physiologique des bois. Les résultats de cette étude, comparés à ceux de la pratique et des essais physiques, permettront peut être de prévoir sur des échantillons petits et peu nombreux, les résistances que le bois pourrait fournir, sa facilité de polissage, etc. . . Cet examen pourra être des plus utiles pour le choix des essences les plus convenables entre les bois qui poussent pêle-mêle et si variés dans les forêts des Colonies.

Dans les essais physiques et mécaniques, la résistance à la pourriture, qui est un des éléments les plus importants de succès, est forcément laissée de côté; l'examen microscopique qui indique la nature, l'importance des vaisseaux, leur degré d'obstruction, pourra peut-être fournir des indications utiles. Peut-être aussi pourrait-on tenter par des trempages dans des bouillons de culture déterminés, réaliser une corruption artificielle des bois injectés ou non, et arriver à un classement à ce point de vue.

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[1] Le bois des Vosges appartient à la même espèce que celui du jura (*abiès pectinata*), mais paraît un peu plus résistant.

[2] Les constatations faites jusqu'ici donnent une usure un peu plus grande pour les bois créosotés que pour les bois non créosotés.

L'étude des bois, pour pavage, à peine ébauchée est donc à poursuivre; elle fournira certainement des résultats intéressants dont l'utilité peut-être des plus générales

A **Petsche**,

Paris, le 9 février 1895. *L'Ingénieur de la 3$^{\text{ème}}$ Section*

APPENDIX VI.

Paris, le 8 Mai 1896.

L'Ingénieur ordinaire a Monsieur Fernandez

Monsieur,

J'ai regretté d'avoir manqué votre visite.

Nous accepterons avec empressement d'essayer diverses essences de vos bois Peut-être en effet la Ville de Paris, avec sa centralisation et ses Laboratoires vous offrira telle un champ d'expérience favorable. Tout à votre disposition, je vous prie d'agréer, Monsieur, l'expression de mes sentiments les plus distingués.

A. **Petsche.**

Vous serez bien aimable de me faire connaître votre adresse aux Indes ou en Angleterre pour le cas où j'aurais des communications ultérieures à vous adresser.

APPENDIX VII.

Containing certain figures of yield and cost.

Paris, le 27 Octobre 1892.

L'Ingénieur Ordinaire à Monsieur Boreux

Monsieur l'Ingénieur en Chef,

L' échantillon type du pavé étant 8 × 22 × 15, un madrier 8 × 22 payé *pour* 2^m de longueur (ayant en général 2^m, 02) fournit en pratique 18 pavés, soit une surface en pavés accoles de 0 2288 1 mètre cube *de bois brut* donne donc *une surface en pavés de 0·15 accolés de 6·50* mètres carrés (369 pavés). Mais sur la chaussée les joints absorbent 0·01 contre 0·08 de largeur de pavés, et occupent $\frac{1}{9}$ de la surface. Dans ces conditions, il suffit de 50 pavés pour couvrir un mètre; les joints de rives (dont l'importance relative varie avec la largeur des chaussées) suffisent à compenser les coupes, sauf dans les voies de tramway: en sorte que l'on peut compter qu' il faut 50 pavés par mètre carré de pavage exécuté.

1 mètre cube de bois brut fournira donc 7·38 mètres carrés de pavage.

Dans nos prévisions nous pourrons tabler sur 7 mètres cubes de pavage par mètre cube acheté.

Sur la base de 50 pavés et de 11 mètres linéaires de réglettes au mètres carré de pavage, le prix de revient par mètre carré de pavage d'après la statistique de 1891 ressort à :—

Pour le pin des Landes, qui est employé dans l'immense majorité des cas,

	Francs	Francs.
Fourniture de bois à 60f le m³.	8 14	
Réception camionnage	0 30	
Main d'œuvre à l'usine	0 66	
Huile lourde-fourniture	0.49	
Fournitures diverses et frais généraux	0 13	
Total à l'usine	6 72	9.72
Chargement	0 03	0 22
Transport à pied d'œuvre	0 19	
Fourniture et transport de réglettes à pied d'œuvre		0 26
Total des fournitures à pied d'œuvre par m² de pavage		10 20

Pour les pavés chanfrenés il faut compter une plus-value de main d'œuvre de 0 40f. par m² (7 90f. par mille).

La statistique n'ayant compris jusqu'ici aucun intérêt ou amortissement, aucune part d'appointements des piqueur, conducteur, etc... (ce qui sera fait désormais), le prix de revient ci-dessus est bien le prix correspondant des dépenses à effectuer, chaque année par la Ville pour l'usine sur les crédits ouverts pour le pavage en bois, et donne les parts relatives à effectuer dans les crédits aux diverses sources de dépenses.

Ainsi sur 100,000f. de crédit il conviendra d'affecter environ :

	Francs	
Achat de bois	80,000	ou les ⅘
Réception et camionnage	3,000	
Huile lourde	5 000	
Main d'œuvre à l'usine et divers	7 600	
Transport à pied d'œuvre	2 000	
Réglettes	2 500	
	100 000	

En marche normale moyenne l'usine doit fabriquer actuellement de quoi couvrir 250 à 300^{m2} par jour. Les dépenses par semaine (en dehors des acquisitions de bois) ressortent donce à environ 3,000f. dont *en salaires à l'usine* 1,000 à 1,200f. suivant l'importance des arrivages et des transports à pied d'œuvre. Ce chiffre de salaires et celui de consommation d'huile lourde seront sans doute réduits en 1898, grâce à l'organisation normale.

Votre respectueusement dévoué,

Signé : PETSCHE.

VI.—MANUFACTURE OF WOOD MATCHES IN FRANCE

MANUFACTURE OF WOOD MATCHES.

I have been able to visit only one factory, *viz.*, that at Saintines St. Sauveur, situated on the railway, 49 miles north of Paris, but as, like all match manufactories in France, this was a State establishment, no information that I asked for was withheld, and I saw there, for all practical purposes, all the various processes of manufacture illustrated Moreover, through the kindness of the Senior Professor of Industrial Chemistry at the University of Nancy, I was able to complete my information at this last town.

The manufacture consists of four distinct sets of operations which I will describe separately, *viz.*:—

I. Preparation of the splints.
II Preparation of the inflammable paste
III Tipping of the match ends.
IV Manufacture of the boxes and packing

I.—PREPARATION OF THE SPLINTS.

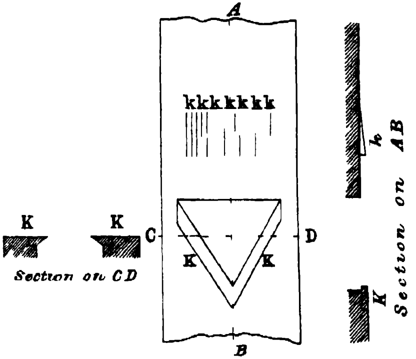
This is the process which specially concerns the Indian forester, as without attempting to make matches, the Department can legitimately undertake this branch of the business.

The splints may be prepared either purely by splitting or by a special process of turning

A.—The Splitting Process.

The simplest and most primitive form of machine employed was a hand one, consisting of a strong sharp knife moving vertically between guides and worked, like the blade of an ordinary tobacco-cutter, by the mere force of leverage. The wood was first sawn into parallelipipeds, the height of which in the direction of the fibres was equal to the desired length of a match The parallelipipeds were then passed one by one, the fibres lying horizontally, under the knife, and split up into plates of the thickness of the future splint. Lastly, a number of these plates, arranged together evenly, were cut in the same way at right angles to the original plane of section, the result being splints ready for tipping By adapting to this primitive contrivance a stage possessing, by means of a ratchet and pinion, a horizontal movement capable of automatically feeding the wood under the knife, we have a very simple and inexpensive machine for employing the spare time of poor families in districts where, as in our Indian forest regions, rates of wages are low A woman of ordinary strength could easily turn out 10,000 splints in an hour for ½ anna (a very high rate of wages), so that a million would cost 50 annas or about 3*s* 6*d*., say, 7*s*, if cost of sawing the parallelipipeds be added.

From this to the machinery at Saintines is a long step in advance. There the logs (stored up, while still full of sap, in cellars in order to undergo some degree of fermentation, which softens the wood) are first cut up into thick planks with a ribbon saw, then, with a circular saw into parallelipipeds of the height of a match All outer slabs are utilised for packing cases. The parallelipiped-shaped blocks are now taken to the machine which is to cut them up into splints This machine consists of a strong heavy rectangular iron frame moving horizontally rapidly backwards and forwards and carrying on either side of it a number of parallel little knives (k, k, k, in sketch opposite) fixed the thickness of a match apart from one another, followed immediately behind by a large V-shaped knife (KK). The blocks of wood are fixed on the machine on either side of the frame in a row one behind another and pushed forward, by a combination of ratchet and pinion, at each stroke the thickness of a match against the frame in front of the advancing little knives. These slit the wood to the required depth, and the large V-shaped knife, coming immediately behind like a plane, then completes the separation, the splints falling through the frame on to a revolving, endless band of canvas, which carries them forward and drops them into baskets placed to receive them. Thus at each forward movement of the frame as many splints may be cut as there are parallel little knives on both sides of the frame, less one.



Although extremely convenient to use, the machine just described possesses the drawback of turning out splints which are rough and ragged at the edges, so that, if they are to be used for matches of finished appearance, they must be put through a process of smoothing Moreover, the splints that drop from the outer faces of the blocks are seldom of the proper thickness and may even be mere chips Hence when matches of high quality are to be made, the splints must be passed through a sifting and polishing machine This consists simply of revolving cylinders of wire netting, resembling those for sifting tea. The under-sized pieces fall through, while the constant friction with one another and with the wire netting smooths the splints and rubs off the ragged edges In order to economise space, time and labour, the sifting and smoothing cylinders are combined with another turning in a room through which a current of hot, dry air is driven. For the wants of the general Indian consumer, who thinks little of the finish of his matches so long as he can buy a cheap article, the drying cylinder alone would suffice to get rid of absolutely useless chips.

From the smoothing cylinder the splints drop on to arranging machines (*rangeurs*), which are merely boxes moving with a short jerky motion both backwards and forwards and up and down, whereby they are laid parallel to one another in a heap, so that they can be swept off at once and packed tight in a box, in which they are carried away to the dipping room or packed up for export to other factories, where only the dipping process is carried on

B—The Turning Process

Here there is no need at all for the ribbon saw, the logs being simply cross-cut into billets, the length of which (usually over 3 feet) is some exact multiple of a match length. Sometimes it suffices to use the wood perfectly green, but it is always best to steam the billets The lathe is a very powerful one and is so geared that as the billet fixed upon it revolves, the cutting blade, which is slightly longer than the billet, gradually approaches the axis on which this turns, the rapidity of approach, which can be regulated exactly, being directly proportional to the thickness of the sheet of wood to be cut, *i e*, to the required thickness of the matches It will be seen that so far the machine is exactly the same as that used for cutting out veneers But here comes an addition The sheet of wood, as it is cut by the lathe, is drawn on to a table under a roller armed with a number of sharp blades entirely encircling it and fixed parallel to each other at the distance of a match length apart Thus the sheet is divided into continuous strips the width of which is an exact match length Immediately behind the roller the strips pass under a long sharp blade working vertically up and down, guillotine fashion, which chops them up into the final splints, all of equal dimensions and requiring only to be dried

It will have been observed that in this process there is no waste of wood, for what falls off the billet before it is turned perfectly cylindrical, and the thin ruler of wood that gets ultimately left on the lathe cannot be called waste Three other important advantages attaching to it are—(1) that the work is done more expeditiously, (2) that the machinery occupies less space, and (3) that less motive power is needed than in the splitting process On the other hand, more skilful labour is needed.

A perfect cylinder of wood 14 inches in diameter and 40 inches long would, barring accidents, be cut into a sheet quite 1 800 feet long, yielding a little more than 400,000 splints, the time required being less than three hours

II.—THE PASTE.

In a general manner it may be said that every paste must contain some proportion of—

(1) *An oxide*, such as potassium chlorate, potassium bichromate, lead peroxide, manganese peroxide, nitrate of lead, chromate of lead, minium, etc

(2) *An easily inflammable substance*, such as phosphorus, sulphuret of antimony, sulphur, iron pyrites, potassium ferrocyanide, carbon, potassium, etc.

(3) *A substance for maintaining combustion, e.g.*, sulphur, wax, stearic acid, paraffin, resin, etc.

(4) *A colouring matter for easy recognition of the tip*, such as umber, ultramarine, cobalt, etc. It may include some substances already required under (1) and (2), such as lead peroxide, sulphuret of antimony, etc.

(5) *A substance for increasing friction, e.g.*, powdered glass or quartz, fine sand, infusorial earth, etc.

(6) *A glutinous substance to help to form a stiff paste and to hold together the various other ingredients, e.g.*, gum, glue, and more rarely dextrin and white of egg.

Broadly speaking, the paste for tipping may be of two distinct kinds according as it contains within itself all the necessary ingredients or only a part of these ingredients, the rest being transferred to the friction surface on the box or elsewhere. In the first case yellow phosphorus is nearly always used, and we have the so-called "phosphorus matches"; in the other, no phosphorus at all is used in the tipping paste and only red phosphorus on the friction surface, and we have the so-called "safety matches". Red phosphorus ignites only at or near 240° C. (464° Fah.) and is less harmful to health.

There are very various formulæ for the preparation of either kind of paste, but the most commonly used in France are *—

For Phosphorus Matches.

I.

Yellow phosphorus	1·5 parts.	
Gum tragacanth	3·0 ,,	
Lamp-black	0·3 ,,	
Minium	5·0 ,,	The dried mixture of these two.
Nitric acid at 4° Baumé	2·0 ,,	

II.

Yellow phosphorus	3 parts.
Gum tragacanth	3 ,,
Peroxide of lead	2 ,,
Fine sand and smalt	2 ,,

The mixture of the phosphorus is effected thus:—

The gum, dissolved in a little water to secure the consistence of a thick syrup, is heated to 50° C., and the phosphorus is added little by little, the mixture being constantly stirred in a mortar until a sort of thick ointment is the result.

FOR SAFETY MATCHES.

A.—For the Tipping Paste.

I.—(Noiseless ignition).

Potassium chlorate	5 parts.
,, bichromate	2 ,,
Powdered glass	3 ,,
Gum	2 ,,

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* My notes contain 60 different formulæ, to give all of which would occupy too much space in this Report, which is more specially concerned with the conversion of the wood.

II.—(*Noiseless ignition.*)

Potassium chlorate	59·3	parts.	
Barium chromate	21·6	„	
Sulphur	2·3	„	only if matches are to be used in the open air.
Powdered glass	4·0	„	
Gum	12·8	„	

III.—(*Ignition with slight explosion.*)

Potassium chlorate	52·8	
Peroxide of manganese	6·0	
„ , iron	6·0	
Potassium bichromate	5·0	
Sulphur	3·0	If the matches are to be used in the open air.
Powdered glass	12·0	
Chalk or colophony	1·2	
Gum arabic	10·0	
„ tragacanth	3·0	

B.—For the Friction Surface.

Sulphuret of antimony	5	parts
Red phosphorus	3	„
Peroxide of manganese	1½	„
Gelatine	4	„

The *rationale* of the composition of every kind of paste for safety matches is as follows :—

(*a*) The essential element for ignition is the potassium chlorate, which constitutes from 40 to 92 per cent. of the whole mass, generally over 50 per cent.

(*b*) Some easily inflammable substance if necessary, such as sulphur, paraffin or charcoal. The sulphur and paraffin need not be mixed in the paste ; dipping the splint end before tipping suffices.

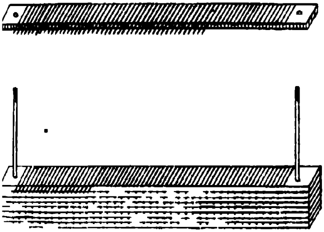
(*c*) In order to moderate the rapidity of the explosion and to secure a quiet more prolonged combustion, sand, powdered glass, umber, etc., are used.

(*d*) In order to economise the chemicals, the mass of paste prepared as above may be increased to the extent of 33 to 50 per cent. by the addition of such substances as pumice, plastic clay, etc.

The chlorate should always be quite pure and reduced in a stone mortar reserved for it alone. The other ingredients, the glue or gum excepted, being ground together very fine in an iron mortar, the chlorate, moistened with a little alcohol, is then put in and the whole mixed together gently to avoid explosion. Lastly, the glue or gum, dissolved almost to a liquid, is added, and the entire mass worked into a smooth paste, which must be used on the very day it is made.

III.—TIPPING THE MATCH ENDS

The splints have first to be dipped for a part of their length in sulphur or paraffin, in order to enable combustion to be maintained once the match has been ignited; and then tipped with the inflammable paste. In order to effect both operations quickly and with ease, the splints must be fixed, a large number together and slightly apart from each other, in a portable frame.



Dipping Frame

A simple form of frame, which can still be used where labour is cheap, is figured opposite. A number of battens about 2 feet long, ⅛ inch thick and ⅛ inch or so less in width than the length of the splints, are capable of being fixed together by means of a bolt passed through each end. Each batten is scored across one side with grooves, a small fraction of an inch apart and almost deep enough to contain a splint. Splints are laid in the grooves as the battens are successively placed over one another, and the whole is then bolted together fast. But before the bolts are finally tightened, the frame, with the projecting splint ends upwards, is placed on a perfectly flat surface of metal or stone, and these ends are beaten down gently, so that they ultimately stand all on the same level

The frame is then, with the splint ends downwards, dipped into melted sulphur kept in a shallow iron pan with a perfectly flat and level bottom, the depth of sulphur not exceeding ⅛ inch. The frame is shaken over the pan to get rid of excess of sulphur. The sulphur dries in less than a minute, as soon as it is cold. About 17½lb are required for 1,000,000 matches.

If paraffin is used, as it should be completely absorbed into the pores of the wood, the splints have to be perfectly warm and dry and be kept soaking in the paraffin for a minute or two. Special paraffining apparatus have been constructed. The use of paraffin is more expensive than sulphur, although only 6½ to 8lb are required per 1,000,000 splints.

Lastly the inflammable paste is applied by laying it thickly, with a roller like a printer's roller, on a smooth surface of stone or ground glass and then resting the frame on this for a few seconds.

It now only remains to dry the tipped ends For this purpose the frames, still holding the matches, are placed on stands divided off horizontally into shelves and running on rails • The stands are pushed into the drying chamber at one end and dragged out at the other. A current of hot dry air is constantly driven through this chamber.

When the frames are opened, the matches are not allowed to drop out anyhow. Each batten is taken out separately and the matches on it slipped off, standing on end, against the edge of a wooden tray or a similar layer previously slipped off. In this way the matches get regularly arranged, all the tipped ends upwards, for the packing room. A special apparatus also exists for arranging the matches in this way when they are removed from the frames.

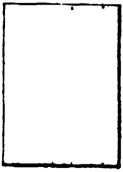
Working with the hand, a man can fix up about 50,000 splints in the dipping frame in a day of eight hours.

At Saintines the work is done by machinery. A similar frame to the hand one is placed, with the bolts loose, inside a box, which is jerked violently with a combined vertical and horizontal motion backwards and forwards by special gearing. By this peculiar movement the splints, thrown loosely over the frame, fall of themselves into the grooves. The bolts are then tightened, the frame removed and the superfluous splints lying on it shaken off. By this method a single workman can fill 700 frames of 2,250 splints each = a total of 1,575,000 matches, in a day.

IV.—Manufacture of the Boxes and Packing.

The matches are packed either in paper or wooden boxes. The former are an entirely new introduction and are still under trial They are of the envelope pattern and are intended to secure a small economy; but as it does not pay to have expensive cases for such a cheap article as wooden matches, the box they have hitherto succeeded in devising is greatly wanting both in finish and solidity.

The wooden boxes are of the usual pattern (*coulisse et tiroir*, case and drawer). The wood for them is cut with a machine similar to that used in the turning process for splints, except that the sheet is merely cut into short strips about 14 inches long, and, for the cases, also scored along the lines along which they are ultimately to be bent to an angle (see fig. opposite). The drawers are made in a special machine, which cuts the strips into the required lengths and shapes, and bends and folds these, pasting paper round the sides and edges. Similarly, a special machine forms the cases, while a second pastes on the labels and a third brushes the friction paste on to the sides. All these machines are extremely ingenious and labour-saving, and are managed exclusively by women, eight of whom are able to turn out more than 30,000 complete boxes in a day.



Obviously the boxes are filled by female labour. The women have by practice become so expert that they can without any hesitation grasp almost invariably the exact quantity of matches that will go into a box, and then, with a single movement of the hand, push them all in. One woman can fill nearly 20 boxes in a minute.

The filled boxes are wrapped up, again by women, in paper in bundles of a dozen each; and finally the bundles are packed into wooden cases by men and carried away for export.

At Saintines all the work described in this section is done on the upper floor of the factory, the ground floor being occupied by the heavier machinery required for cutting the splints and the boards for packing cases, and by the steam motor. It is hardly necessary to say that the inflammable paste is prepared in a shed standing by itself.

V.—GENERAL STATISTICS

Through the kindness of the Superintendent, I give below the cost of the machinery set up at Saintines :—

	£
Ribbon saw	112
Circular saw	72
Machine for splitting the splints . . .	208
Drier, cleaner and arranger (*rangeur*) for the splints .	84
Machine for arranging the splints in the dipping frame	48
,, ,, paraffining the splints	68
,, ,, spreading the inflammable paste .	32
,, ,, arranging the matches after removal from the dipping frame	26
Lathe for cutting the wood for the boxes . .	60
Machine for making the case portion of the boxes . .	72
,, ,, ,, ,, drawer portion of the boxes .	92
,, ,, pasting the labels	60
TOTAL .	934

If the cost of the steam motor of the mill for preparing the inflammable paste, and of other tools and fittings not included in the above list be added, the total will mount up to a little over £1,100. I omit all reference to the buildings, as a statement of their cost would be of no interest in drawing up an estimate for the establishment of a similar factory in India. Suffice it to say that in India we can build at a quarter of the figure required in Europe.

The workmen at Saintines are paid from 4 to 5 francs (3*s* 3*d*. to 4*s*.) a day, the women from 2 50 to 3 fr. (2*s* to 2*s* 6*d*.) At these rates the cost of labour alone is approximately as follows :—

Per	1 000 000	splints . . .	10	francs	= 8*s*
,,	1,000,000	safety matches . .	50	,,	= 40*s*
,,	1,000	boxes . . .	0 70	,,	= 6¾*d*

Thus the cost of labour expended on 1,000 boxes of safety matches, containing 50 matches each, is only 2*s* 6¾*d*. If the price of the chemicals, wood, paper and paste and the corresponding proportion of the capital expenditure be added, the cost of production of 1,000 such boxes will not exceed 5*s*. The corresponding figure for Swedish-made matches cannot be higher than 4*s*.

At Saintines aspen is used for the matches and black poplar for the boxes. Elm has been employed successfully for the latter purpose, but is too expensive and is harder to work than poplar. The best quality of matches made at Saintines are, however, not produced from home-grown wood; the splints, very even and clean, come from Russia and are probably made from birch.

The consumption of matches in France exceeds 70,000,000,000 a year, of which roughly ⅛ are tapers, and of the rest rather less than 50 per cent. safeties.

VI.—Application to India.

It is an extraordinary fact that in the remarkable industrial development which has distinguished the past twenty years, the manufacture of matches has been left severely alone, although they are an article of daily consumption in every house and in nearly every hut in the country, and although the most important conditions for success have always existed, *viz.*, cheap suitable wood in abundance, cheap labour and fuel where the wood grows, in many places unlimited water power, and the fact that the manufacture of matches requires only moderate skill and special knowledge, and a comparatively and even absolutely small initial capital.

It hardly lies within the province of the Government of India to undertake match-making as a permanent State industry; nevertheless, just as in the case of tea it gave the original incentive to private enterprise by establishing tea-gardens and a tea-factory of its own, so in the present instance it will not be derogatory to its position or foreign to its scope to establish a match manufactory on the scale of that at Saintines, which is only one of several that the French Government possesses in pursuance of its monopoly. The success of such a venture is a certainty, and once this success is recognised by the public, private enterprise will not be long in stepping in to take over the business from Government.

For matches we require a soft, loose-fibred wood that burns with a steady flame without sputtering, whereas for the boxes we want a wood which, while it is not too hard to be easily worked, has long strong fibres that are sufficiently anastomosed to be capable of being bent to an angle without breaking. Of such woods we have nearly everywhere a larger supply than we can ever need, and for so many of them there is at present absolutely no market.

It remains to consider only the financial aspect of the proposed venture. I have shown above that the factory at Saintines cost, exclusive of buildings, £1,100. Let us suppose that a similar installation of machinery and tools in India would cost R30,000; the buildings would require another R30,000, including a small house for a European foreman and his family; total, Rs. 60,000, which is really an outside figure, since actually we shall not require all the machinery used at Saintines. For instance, there will be no need for a sifter for splints, nor for a paraffining apparatus.

Even with the inferior workmen we must employ, it would not be too much to expect an outturn of 2,000,000 matches, or 40,000 boxes a day, or 12,000,000 a year. These ought to sell readily at the factory at 1 pie a box, yielding R62,000. Considering the great cheapness of our labour and making full allowance for the wages of the European foreman and his wife, it would be a very outside figure to assume R4 as the cost of manufacture of 1,000 boxes (see p. 119). Thus the expenses being R48,000, the net take-in would be R14,000 on a capital of R60,000, or a return of 26 per cent. Thus even with a lower selling rate than 1 pie per box there would be a handsome percentage of profits.

In time, under the teaching of the European foreman and his wife, the work-people, both men and women, would become very expert and the cost of manufacture might fall as low as R3 per 1,000 boxes of safety matches. The cost of phosphorus matches would from the commencement be 30 to 60 per cent. lower than that of safeties.

VII.—COMMUNAL FOREST OF PIERREFEU AND THE CORK OAK.

The Communal forest of Pierrefeu is situated about 16 miles east of Toulon and immediately to the east of the large and prosperous village of that name. The Commune lies about 6 miles south of the railway going from Toulon to Nice and has a population of 2,267 souls. Its area is 5,789 hectares, of which 2,819 hectares (=6,966 acres) are comprised in the forest under report.

The elevation of the village above the sea is 490 feet and the forest area lies between about 550 and 800 feet, entirely on a large straggling hill with more or less easy slopes. The soil is a fairly rich sand, very loose and naturally dry, and rests on sandstone. Of the 6,966 acres comprised in the forest about 1,000 contain no cork oak, while over the rest of the area it is met with everywhere, but nowhere very abundant or large, the reason being that until a few years ago, when the present energetic Divisional Officer, M. Tassy, completely changed the system of management, the theory of timber before everything was pushed to the extreme, with the result that the oak languished, if it did not perish, under the all-invading and fast-growing Cluster pine. Now, it being at last acknowledged that cork, a special product restricted by the nature of the oak, to a limited area, is more valuable than timber, the treatment is regulated to favour the oak and the production of cork as much as possible and to deal with the pine as an auxiliary to fill up the intervals between the individuals of the principal species. Hence in a near future the stock of the cork oak will be more than quadrupled and will consist of larger and therefore more productive trees.

The present yield of bark realises 46,345 f. or 5*s*. 3*d*. per acre per annum. M. Tassy is certain that by the end of the next twenty years the yield of bark will be worth 200,000 f. or nearly 23*s*. per acre per annum, and this in spite of the great fall that has taken place, and is still taking place, in the price of cork. When the price of the timber and firewood is added, the gross return will not be less than 30*s*. per acre per annum. Besides the ordinary cuttings, which yield 5,000 f. a year, or 7*d*. per acre per annum, the Commune has been allowed the benefit of extraordinary fellings, spread equally over 8 years, of the total value of 527,000 f. (£2,635 per annum and 7*s*. 6¾*d*. per acre per annum). Besides the value of the direct produce of their forests, the people of the Commune get the benefit of all the wages and profits connected with the working out of the cork and wood. Already there are no local rates or taxes to pay, so that when the forest is in full production, the inhabitants will have yearly a substantial margin of profits for distribution among themselves, as the regular expenditure of the Commune amounts to less than 40,000 f.

By agreement with the Commune, the State is entitled to one fifth of the value of the cork for improving the forest. The measures of improvement are—(1) protection from fire, which at present costs only 500 f. (=£20) a year, (2) *débroussaillements* (described in the next paragraph), and (3) thinning out of the pines among themselves, for which operation 2,000 f. (£80) a year are allotted.

The *débroussaillement*, which costs on an average 20*s.* per acre comprises the following operations:—

(*a*) Pulling up by the roots all brushwood and bushy and creeping vegetation, with the exception, when pointed out by the guard of the beat, of arbutus and phyllarias in blanks, which plants have then merely to be cut back.

(*b*) Cutting down to the ground marked pines surrounding cork oaks and pruning the remaining pines up to one-third of their height.

(*c*) Cutting back below the level of the ground badly-grown cork oaks pointed out for this operation, and pruning quite clean the stems of others that are branched.

The *débroussaillement* is done twice over in the same year, the second operation being limited to the pulling up by the roots and burning of all brushwood that has made its appearance since the first operation. The *débroussaillement* is always carried out by contract under very stringent conditions (see the printed paper, Appendix I).

The *débroussaillement* simplifies fire-protection, which consists merely in clearing, once for all, the boundary line (where necessary) and certain roads of dead leaves and all herbaceous vegetation. No special establishment at all is kept.

The *débroussaillement* also helps the appearance of both pine and cork oak seedlings, but the former have always to disappear in the very next *débroussaillement* in the neighbourhood of the latter.

The thinning of the pines is made just as much in the interests of the oak as to favour the growth of that species. Great stress is laid on having every individual of the cork oak completely free not only overhead, but also laterally. Until a few years ago the close and rapid growth of the pine gave no chance to the oak; the few seedlings of it that survived grew up weak and deformed, and from not having sufficient light round and over them, produced thin bark of inferior quality. Radical thinnings had thus become urgent, and the demand from the Commune for extraordinary fellings came most opportunely to secure the necessary liberation of the oaks. As said before, these fellings were spread over a period of eight years and in them every pine 70 centimètres (roughly 27½ inches) and upwards in girth was removed. The current year has been the last one for these fellings, and the good results are most marked everywere.

There is no working plan for the forest, as the Commune is unwilling to bear the cost of one and to be tied down too strictly. Fortunately, the plan followed for exploiting the bark of the oaks secures a sufficient amount of fixity and regularity.

I will now describe briefly—

(i) the method of exploiting the bark of the cork oak; and

(ii) treatment of the rough or virgin bark to convert it into the cork known to every one.

I.—Method of Exploiting the Bark of the Cork Oak.

If a tree is left to itself, a corky rhytidome, it is true, forms over the trunk, but this layer of cork is not only comparatively thin, but is useless for commerce; and the only way to produce commercial cork is to remove that layer right down to the commencement of the cork cambium, which thereupon displays unusual activity and forms a new thick rhytidome possessing the required uniformity of texture and elasticity. The operation of removing the original rhytidome is termed *démasclage* and must be effected as soon as the tree in question has attained the minimum girth deemed necessary for assuring the safety of the tree under the treatment to follow. With these preliminary remarks I will proceed to summarise the conditions fixed by Ministerial order for the exploitation, and contained in the printed document hereto attached and marked Appendix II.

The right of exploiting is usually farmed out for periods of twelve years at a time, and the farmer takes upon himself all risks and responsibilities, save in the event of a fire not caused by himself or his men spreading over at least three-fifths of his area, when he has the right to claim a cancellation of his lease, without however being entitled to any refund of money paid or compensation for produce or money lost. In Pierrefeu it has been found advantageous to divide the forest into eight blocks and farm out each block separately.

As soon as he has obtained the lease the farmer must begin the *démasclage* of all the trees that are at least 50 centimetres (nearly 20 inches) in girth measured over the bark at 1 metre (40 inches) from the ground; and during the entire currency of his lease the *démasclages* must be continued and extended upwards as the trees grow in height, and new trees must be taken in hand as soon as they attain the minimum girth given above.

The farmer can each year begin removing the cork from the moment the sap rises up to the 15th August, and he must clear all the year's produce out of the forest by 15th September; but the Conservator has power to grant an extension of time on just cause being shown and on payment of any indemnity fixed by him.

The farmer can remove a complete cylinder of bark whenever its thickness is not less than 23 millimetres ($\frac{9}{10}$ inch) along at least nine-tenths of the upper or lower edge, and there only where the bark is regular and sound.

The cylinder must be taken off from as near the ground as possible, and its height should not exceed twice the girth of the trunk measured over the bark at 1 metre from the ground.

Branches may be worked provided, they are at least 60 centimetres (2 feet) in girth 1 metre above their point of insertion; but in that case also the total length of the cylinders taken from the tree cannot exceed twice the girth of the trunk as above. The Conservator has, however, the power to modify this last condition by means of a special clause or clauses.

In no case may a tree be barked in one and the same year or during the course of two consecutive years over more than 1½ metres (5 feet) of its trunk, and no tree barked for two years running can be barked again for at least another year.

The farmer is bound to remove the bark of trees which have attained the age of 18 years without developing 23 millimetres at least of cork. The bark under such conditions is said to be superannuated (*écorce mûre*), as its maintenance prevents the cork cambium from ever resuming full vigour. This is really a case of true hide-binding.

The farmer is equally bound to remove bark that has been charred by fire. What produce he obtains in this and the previous operation belongs to him free of royalty. The farmer must prune perfectly clean the trunk above the portion where the bark has been taken off, and this over a length equal to the length of the cylinder of bark removed.

Immediately a cylinder of bark has been taken off, two or more slits parallel to the axis of the trunk and equally removed from one another, must be made with a knife through the living bark, right down to the wood. This operation increases the activity of the cambium by diminishing the tension over it.

The felling of any cork oak, abusive *démasclage* or removal of bark resulting in death, and tearing off any portion of the wood or cork cambium, are acts for which the farmer is liable to be sued criminally as well as civilly.

For all other acts of commission and omission contrary to the terms of his lease the farmer is also criminally and civilly liable; and in case work that he is bound to do has not been done in time, the Forest officer has authority to execute it and recover actual expenses from the farmer.

The granting of a farm for cork does not preclude the Forest officer from selling to a third party wood or other produce from the same area.

After what precedes it is unnecessary to add that the cork is always taken off in complete cylinders from all round the trunk, and is then at once flattened out, whence the term "*planche*" for a complete piece. No little skill is required to prevent the cork cambium and even the underlying portion of the bark right down to the wood from being torn away; the workmen are therefore specially selected and receive as much as 5f. (4*s*) a day. Cork being impermeable to moisture and not easily liable to decomposition, the virgin cork remains exposed to sun, rain and dew and gives no trouble to store or transport.

The price of the *planches* varies, according to thickness and quality, between 80 and 180f. per 100 kilogrammes (= 11 and 65*s*. per 100 lb).

II.—TREATMENT OF THE "PLANCHES" OR VIRGIN CORK.

The cork as it comes off the tree is hard, uneven, thin and deficient in elasticity; moreover, its colour is dark and not uniform. These defects are removed by boiling for 1 to 1½ hours in ordinary water in large open vats, the cork being tied up loosely in bundles in order to be kept down under water the more easily. The water removes all the soluble colouring matters and other substances such as tannin, etc., becoming a deep brown. The *planches*, now nearly 50 per cent. thicker, are taken out and spread out under boards, so that they may dry perfectly even and flat. The specimen labelled A is a sample of unboiled bark, while B represents the same after it has been boiled.

To prepare corks for bottles the slabs are cut into strips the width of which is slightly greater than the diameter required, and the strips are divided into parallelipipeds of the same height as the future corks. The parallelipipeds are then cut upon extremely ingenious hand lathes costing only 180f. (£7 4*s.*) each and capable of being worked by women and girls. The piece of cork to be turned not only revolves rapidly, but is also drawn backwards and forwards, as it revolves, along the entire length of the cutting blade. Without such double motion it would be impossible to cut clean and smooth so springy and elastic a substance as cork. This double motion is secured very simply by sliding a male screw, to which is attached one of the chucks holding the cork, backwards and forwards inside a female screw, the women working the machine using only one hand for the purpose. Two or three motions backwards and forwards suffice to turn a cork completely, so that a woman can prepare from 6 to 10 corks a minute. Before they are fit for the bottles the corks have to be treated with chloride of lime and benzine, the first to bleach, the second to remove dirt and grease. Samples of parallelipipeds and bleached and unbleached cork accompany this Report.

Until recently the corks were cut by hand, but this required the highly skilled labour of men and rather more than double the time. On the other hand, less bark was wasted, as the parallelipipeds require to be hardly thicker than the corks to be turned out, and, it is alleged, the corks were better cut. The cutters were all Spaniards or Portuguese.* Four samples of hand-cut cork accompany this Report. The ridges and uneven surface they show would disappear in the bleaching process.

The weight of cork turned out to weight of bark used is, on an average, only as 33 to 100. A considerable proportion of this waste consists of the hard or half-decomposed stuff removed from the two surfaces of the slabs and is quite useless, but the rest of the waste is utilised for making Linoleum and realises a fair price.

The cost of boiling, cutting up into parallelipipeds, turning and bleaching comes to 1·85f. (= 18*d.*) per 1,000 corks. The cost of turning alone is 4¾*d.* to 5¼*d.* per 1,000 for conical, and 6¼*d.* to 6¾*d.* per 1,000 for cylindrical corks.

As the workwomen are paid according to the number of corks they turn, and the corks are sold by number, a most ingenious counting machine is used, with which, by simply turning a handle like that of a windlass, thousands are counted in a few minutes. The machine costs only 500f. (=£20).

Many of the cork factories in France have closed and the rest are in a bad way owing to competition from Germany and Russia. As there is no customs duty on manufactured cork, the German and Russian manufacturer, thanks to cheap labour, can buy the rough bark in France, take it home, and then send it back manufactured to France and even then undersell the French manufacturer.

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* In Naples a great deal of cork-cutting is done by hand, but this industry is no doubt a survival from the days of Spanish domination.

APPENDIX I.

Cahier des Charges et Conditions Générales imposées aux Entrepreneurs de débroussaillement dans les forêts communales de l'Inspection de Toulon.

Article Premier.

Les marchés relatifs aux travaux d'amélioration à concéder par voie d'adjudication publique et par voie de marché de gré à gré, dans les forêts communales de l'Inspection de Toulon, sont soumis aux dispositions suivantes :

TITRE 1er,—DES ADJUDICATIONS.

Article 2.

Nul ne pourra être admis à concourir s'il n'est muni d'un certificat constatant sa capacité.

Article 3.

Ce certificat, délivré par un agent forestier, ne devra pas avoir plus de trois ans de date au moment de l'adjudication. Il y sera fait mention de la manière dont les soumissionnaires ont rempli leurs engagements, soit envers l'Administration, soit envers les tiers, soit envers les ouvriers, dans les travaux exécutés ou surveillés par eux. Ces travaux devront avoir été faits dans les dix dernières années.

Les certificats de capacité seront présentés à l'Inspecteur des Forêts, dans les cinq jours qui précéderont l'adjudication, et seront rendus aux titulaires, immédiatement après la séance d'adjudication.

Article 4.

Les adjudications sont annoncées par voie d'affiches, indiquant le lieu, le jour et l'heure de l'opération.

Article 5.

Le Bureau sera composé du Maire de la commune de la situation des bois, président, ou de son délégué, et de deux agents ou préposés forestiers. — La minute du procès-verbal restera déposée dans les archives du chef de service.

Article 6.

Les adjudications auront lieu aux enchères et de la manière suivante :

Le prix de base sera le prix des travaux à l'hectare. Ce prix, ainsi que le taux auquel les criées devront être arrêtées, sont déterminés par le Président, sur l'avis du Bureau.

La mise à prix, annoncée par le crieur, sera augmentée successivement de franc en franc, jusqu'à ce qu'une personne prononce les mots. *Je prends.*

L'adjudication sera tranchée au taux du chiffre que le crieur aura énoncé ou commencé à énoncer lorsque ces mots seront prononcés.

Si plusieurs personnes se portent simultanément adjudicataires, le lot sera tiré au sort entre elles, à moins que l'un des preneurs ne réclame la mise au rabais. Dans ce cas, l'adjudication sera faite entre les preneurs après l'extinction de trois bougies allumées successivement ; si, pendant la durée de la dernière de ces bougies, survient un nouveau rabais, l'adjudication ne pourra être prononcée qu'après l'extinction d'un dernier feu sans rabais survenu pendant sa durée. Les rabais porteront également sur le prix de l'hectare et devront être d'un nombre entier de francs.

Article 7.

Le Bureau pourra exiger la présentation, séance tenante, d'une caution reconnue solvable, qui s'obligera solidairement par l'acte même d'adjudication à toutes les charges et conditions de l'entreprise.

Article 8.

Les résultats de l'adjudication seront constatés par un procès-verbal relatant toutes les circonstances de l'opération et signé, sur-le-champ, par les membres du Bureau, les Entrepreneurs et les cautions.

Toutefois, l'adjudication ne sera définitive qu'après avoir reçu l'approbation du Préfet ou du Sous-Préfet de l'arrondissement.

S'il n'a pas été statué dans le délai d'un mois à dater du jour de l'adjudication, le soumissionnaire pourra exiger la résiliation du marché. Il ne pourra prétendre à aucune indemnité dans le cas où le marché ne serait pas approuvé.

Article 9.

Dès que l'approbation du marché lui aura été signifiée, l'Entrepreneur devra verser à la caisse du Receveur des Domaines du lieu de l'adjudication : 1° Les frais de timbre du procès-verbal d'adjudication et de l'expédition délivrée pour le service de la comptabilité ; 2° les frais d'enregistrement concernant son marché ; 3° le prix du timbre des pièces qui lui seront délivrées sur sa demande.

Sur la présentation du certificat du Receveur des Domaines constatant le paiement de ces frais, l'Inspecteur des Forêts délivrera à l'Entrepreneur le permis d'exécuter les travaux ; ce permis, non soumis au timbre et à l'enregistrement, servira à l'entrepreneur de pièce d'accreditation auprès des agents et préposes locaux.

Est également à la charge de l'Entrepreneur le prix du timbre du procès-verbal de réception définitive qui devra être signé par lui pour acceptation.

TITRE II.—DE L'EXÉCUTION DES TRAVAUX.

Article 10.

En aucun cas l'Entrepreneur ne pourra sous-traiter, c'est-à-dire céder à un tiers tout ou partie de son marché.

En cas d'infraction à cette clause, le Préfet ou le Sous-Préfet de l'arrondissement pourra, sur la proposition du service forestier, soit prononcer la résiliation pure et simple du marché, soit ordonner qu'il soit procédé à une nouvelle adjudication à la folle enchère de l'Entrepreneur.

Article 11.

Il ne pourra, pendant la durée de l'entreprise, s'éloigner du lieu de ses travaux, sans faire agréer, par le chef de cantonnement, un représentant capable de le remplacer.

Dans tous les cas, toutes les notifications relatives à son entreprise seront valables lorsqu'elles auront été faites, soit au domicile qu'il sera tenu dans les quinze jours de l'adjudication, d'élire à proximité des travaux, soit, a défaut de cette élection de domicile, à la mairie de la commune de la situation des travaux.

Article 12.

L'Entrepreneur devra mettre la main à l'œuvre dans un délai de quinze jours, à dater de la réception du permis spécifié en l'article 9.

Il exécutera tous les ouvrages en se conformant aux instructions et ordres de service qui lui seront donnés par écrit, s'il y a lieu.

Les travaux seront exécutés de proche en proche.

En dehors de la saison sèche, du 1er juin au 1er octobre, il ne pourra interrompre, pendant plus d'un mois, sans motif légitime, les travaux en cours d'exécution, sous peine de résiliation du marché, qui serait prononcée par le Préfet ou le Sous-Préfet, sur l'avis de l'Inspecteur des Forêts.

Article 13.

Le nombre des ouvriers sera toujours proportionné à la quantité d'ouvrage à faire ; et la liste en sera remise a l'Agent-Directeur des travaux qui est chargé d'assurer l'accomplissement de cette condition.

Article 14.

Tous les morts-bois, plantes arbustives quelconques et plantes rampantes seront arrachés par racine. Toutefois les arbousiers et phyllarias seront, seulement, recépés dans les vides, sur la désignation du garde local.

L'Entrepreneur coupera rez-terre les pins qui lui seront désignés autour des chênes-liège, et élaguera les autres sur un tiers de leur hauteur.

Il recépera à la serpe, entre deux terres, les chênes-liège malvenants qui lui seront désignés en cours de travaux ; il élaguera les autres rez-tronc.

Il disposera de tous les bois ainsi abattus ou extraits.

Article 15.

Les produits non utilisés seront empilés et brûlés sur les places vides.

Les feux autres que les charbonnières demeurent interdits du 1er mai au 1er octobre, et durant l'époque fixée par l'arrêté spécial annuel pris par le Préfet.

Les places à charbon seront désignées par le Brigadier local.

Article 16.

L'Entrepreneur pourra construire les baraques qui lui sont nécessaires, sur l'emplacement qu'il lui sera désigné par le Brigadier local ; mais les Agents et les Préposés forestiers pourront les visiter de jour et de nuit, sans avoir besoin de se présenter au nombre de deux ou d'être accompagnés d'un officier public.

Article 17.

Les travaux de débroussailement sont tous soumis a un repassage qui sera exécuté dans le cours de l'année, a dater de leur achèvement complet, et a l'époque qui sera fixée par le Chef de cantonnement.

Cette opération consistera dans l'arrachis et l'incinération de tous les morts-bois qui auront repoussé.

Article 18.

L'Entrepreneur sera tenu d'ouvrir, dans le délai d'un mois, à dater de la réception du permis, une laie débroussaillée sur 2 mètres de largeur, sur tout le périmètre de son chantier, pour en permettre l'arpentage, et de fournir au Chef de cantonnement les ouvriers necessaires pour cette opération.

Dans les débroussaillements exécutés en tranchée, cette laie ne sera ouverte que sur l'axe.

La contenance ainsi fixée servira de base définitive pour le marché sans que l'Entrepreneur puisse réclamer aucune indemnité au sujet de la différence entre la contenance ainsi déterminée et celle prévue au marché.

Article 19.

Tout Entrepreneur qui réclamera un réarpentage a l'effet de faire constater une erreur dans l'opération primitive, s'engage, par le seul fait de sa demande, à supporter tous les frais de cette nouvelle opération, il s'engage, en outre, à payer à la Caisse du Receveur des Domaines de la situation de la forêt, une indemnité de 10 fr. par jour de travail sur le terrain ou au cabinet de l'Agent qui en sera chargé, s'il est reconnu que la différence ne dépasse pas la tolérance admise par l'Administration.

Article 20.

Lorsque l'entreprise languira, faute d'ouvriers, de manière à faire craindre qu'elle ne soit pas achevée à l'époque prescrite, ou bien si l'Entrepreneur fait preuve d'incapacité ou de mauvaise foi, en ce qui concerne l'accomplissement de son marché, l'Inspecteur, chef du service local, par une sommation extra-judiciaire, le mettra en demeure de prendre, dans un délai déterminé, les mesures nécessaires pour régulariser la situation. Ce délai, sauf les cas d'urgence, ne sera pas de moins de dix jours, à dater de la notification qui aura été faite.

A l'expiration de ce délai, si l'Entrepreneur ou sa caution n'ont pas exécuté les dispositions prescrites, le Préfet ou le Sous-Préfet de l'arrondissement pourra, soit ordonner l'établissement d'une régie, soit prononcer la résiliation du marché, soit, enfin, ordonner une nouvelle adjudication sur folle enchère.

Pendant la durée de la régie, l'Entrepreneur sera autorisé à suivre les opérations, sans qu'il puisse toutefois entraver l'exécution des ordres des Agents forestiers. Il pourra, d'ailleurs, être relevé de la régie par le Préfet ou le Sous-Préfet de l'arrondissement, s'il justifie des moyens nécessaires pour reprendre les travaux et les amener à bonne fin.

Les excédents de dépenses qui pourront résulter de la régie ou de l'adjudication sur folle enchère, seront prélevés sur les sommes encore dues à l'Entrepreneur, sans préjudice des droits à exercer contre lui et sa caution, en cas d'insuffisance.

Si la régie ou l'adjudication sur folle enchère amenaient, au contraire, une diminution dans les dépenses, l'Entrepreneur ne pourrait réclamer aucune part du bénéfice qui resterait acquis à la commune.

Article 21.

Dès que la mise en régie aura été signifiée à l'Entrepreneur, il sera dressé un procès-verbal détaillé, constatant l'avancement des travaux, ainsi que la situation des ateliers.

Sommation d'assister à l'opération sera faite à l'Entrepreneur et à sa caution, qui pourront, d'ailleurs, l'un et l'autre, consigner leurs observations au procès-verbal.

Article 22.

En cas de décès ou de faillite de l'Entrepreneur, le contrat sera résilié de plein droit, sauf au Sous-Préfet à accepter, s'il y lieu, les offres qui pourront être faites pour la continuation des travaux, soit par la caution si elle y consent, sur mise en demeure préalable, soit par les héritiers ou les créanciers.

Il en sera de même lorsque l'Entrepreneur aura disparu du pays depuis plus d'un mois sans remplir les formalités prescrites par l'article 11 du présent cahier des charges.

Article 23.

En cas d'incendie, s'il était constaté que le sinistre résulte du fait de l'Entrepreneur ou de ses ouvriers, le marché serait résilié de plein droit sur le vu du jugement établissant sa faute ou sa responsabilité, et sans préjudice des peines et dommages encourus.

Si le sinistre, bien qu'ayant parcouru une partie de son chantier, n'est pas le fait de l'Entrepreneur ou de ses ouvriers, il sera tenu de continuer le travail en se conformant aux indications du service forestier. Toutefois si l'étendue non débroussaillée parcourue par l'incendie s'élevait au quart de la résiliation du marché pour la surface brûlée, à défaut d'une entente amiable pour augmentation de prix sur la partie restant à débroussailler.

Dans aucun cas il ne sera admis à réclamer de la commune aucune indemnité, soit pour les modifications apportées dans le travail, soit pour les produits brûlés ou endommagés.

Article 24.

Tout Entrepreneur qui, pour cause majeure et imprévue, ne pourrait achever le travail, le repassage ou la vidange dans les délais déterminés par les clauses spéciales, et aurait besoin d'un nouveau délai, serait tenu d'en faire la demande sur papier timbré, au Conservateur, vingt jours au moins avant l'expiration des termes prescrits. Il s'obligerait, par le seul fait de cette demande, à accepter les réductions imposées par l'Administration dans le cas où elle serait accueillie.

TITRE III.—DES RÉCEPTIONS ET DES PAYEMENTS.

Article 25.

Il sera procédé à la réception provisoire des travaux dans un délai de quinze jours après leur achèvement.

La réception définitive aura lieu à l'expiration du délai de garantie ou du délai fixé pour l'achèvement des travaux de repassage.

Article 26.

Le procès-verbal de réception définitive, contenant décompte général et définitif de l'entreprise sera présenté, sans déplacement, à l'acceptation de l'Entrepreneur.

Si ce dernier refuse d'accepter ou s'il ne signe qu'avec réserve, il devra produire ses motifs par écrit, dans les vingt jours qui suivront la présentations des pièces. Dans ce cas, il sera dressé procès-verbal de la présentation et des circonstances qui l'auront accompagnée.

Passé ce délai, le décompte sera censé accepté par lui, quand même il ne l'aurait signé ou ne l'aurait signé qu'avec une réserve dont les motifs ne seraient pas spécifiés.

Le procès-verbal de présentation devra toujours être annexé au décompte non accepté.

Article 27.

Lorsque le cahier des clauses spéciales ne renfermera aucune clause contraire, il pourra être procédé, en course d'exécution des travaux, à des payements d'acompte, à la suite de procès-verbaux de *réception partielle.*

Ces procès-verbaux ne porteront que sur des surfaces débroussaillées de proche en proche et complètement achevées en ce qui concerne l'extraction des souches, l'enlèvement ou l'incinération des produits non façonnés, les dégagements et les recépages.

Ces réceptions ne pourront avoir lieu que tous les deux mois ; mais, quelle que soit l'étendue de l'entreprise, l'Entrepreneur ne pourra en demander pour moins de deux hectares ; les fractions moindres qu'un demi-hectare n'y seront pas comprises.

Article 28.

Les payements d'acompte ne pourront être effectués que jusqu'à concurrence des quatre cinquièmes au plus de la valeur des travaux reçus.

Le cinquième, retenu comme garantie du repassage, ne sera payé qu'après la réception définitive des travaux.

Article 29.

Il ne sera pas dû d'intérêts de retard pour les payements d'acompte ; mais si l'Entrepreneur ne pouvait être entièrement payé dans le délai d'un mois à dater de la signature du procés-verbal de réception définitive, il serait en droit d'exiger l'intérêt à 4 p. 0/0 pour cause de retard dans le payement de la somme qui lui resterait due à partir de cette époque.

Article 30.

Dans les cas de résiliation prévus par les articles 10, 12, 20, 22 § 2 et 23 § 1, c'est-à-dire par la faute de l'Entrepreneur, ce dernier perdra tout droit sur les travaux non entièrement achevés au jour de la notification de la résiliation et sur la retenue de garantie pour la partie déjà reçue, retenue qui correspond, d'ailleurs, à un travail spécial. Mais un délai d'un mois lui sera accordé pour l'enlèvement des produits extraits à cette date.

Article 31.

En cas de malfaçon, il pourra être fait une réduction sur le prix des travaux négligés. Toutefois, cette réduction, pour être définitive, devra avoir été approuvée par le Préfet ou le Sous-Préfet de l'arrondissement.

TITRE IV.—Dispositions diverses.

Article 32.

Dans le cas où des difficultés s'élèveraient entre l'Administration et l'Entrepreneur sur le sens et l'exécution des clauses et conditions de l'entreprise et ne pourraient être résolues à l'amiable, l'Entrepreneur sera tenu, en attendant la décision de l'autorité compétente, de poursuivre l'exécution des travaux, et, dans le cas où il s'y refuserait, il y serait pourvu comme il est dit à l'article 20.

Article 33.

L'Entrepreneur se soumet à la responsabilité determinée par l'article 206 du code forestier (§1 et 2) à raison des contraventions et délits commis par ses ouvriers et voituriers pendant toute la durée des travaux et jusqu'à la réception définitive.

Article 34.

L'Entrepreneur est obligé : 1° à tenir les chemins et sentiers constamment libres ; 2° à réparer les principales dégradations causées par lui aux chemins et sentiers servant à la vidange, et à rétablir les bornes et marques de limites endommagées par lui et par ses ouvriers et voituriers ; et, dans le cas où il s'y refuserait, il y serait pourvu par une régie, à ses frais, prescrite dans les formes déterminées par l'article 20.

Article 35.

Toute soumission directe ne constituera un marché définitif que par l'approbation du Préfet ou du Sous-Préfet de l'arrondissement. .

N° 163, c. 16-1.

Proposé par l'Inspecteur des forêts, soussigné,
Toulon, le 8 mars 1890.
VICTOR TASSY.

N° 288, c. 21, f° 98.
Vu et adopté :
Nice, le 15 mars 1890.
Le Conservateur des forêts,
C. GALLOT.

Vu et approuvé :
Draguignan, le 25 mars 1890.
Le Préfet du Var,
Par délégation, le Conseiller de Préfecture,
BRUNI.

APPENDIX II.

Bois de l'état des communes et des établissements publics mise en ferme de l'écorce des chênès-liège chaier des charges.

TITRE 1

Des Adjudications.

Article Premier.

Le fermage de l'écorce des chênes-liège est consenti, en bloc, sans garantie aucune, soit de contenance, de nombre d'arbres, d'essence, de dimensions, soit d'âge et de qualité, etc......

Le propriétaire de la forêt ne répond d'aucun cas fortuit prévu ou imprévu; tous les risques et périls, généralement quelconques sont laissés à la charge exclusive du fermier sans que ce dernier puisse se prévaloir des dispositions des articles 1722 et 1733 du Code civil et se dispenser de payer les annuités échues ou à écheoir, le tout en conformité des dispositions de l'article 1772 du même Code.

Réserve faite pour une circonstance exceptionnelle qui sera signalée plus loin (Article 34) le fermier, en cas de sinistre, d'incendie ou de tout autre accident qui aurait détruit tout ou partie de la forêt amodiée, ne pourra prétendre ni à la résiliation de son bail, ni à une diminution du prix de son fermage, ni à aucun dédommagement devant l'indemniser des travaux ou avances qu'il a faits, ou de la perte des produits qu'il aurait dû réaliser ou enfin des bénéfices qu'il aurait pu faire.

Article 2.

A moins de stipulations contraires, insérées dans les clauses spéciales les baux sont consentis pour une période de douze années entières et consécutives.

L'adjudication se fera en nombre entier de francs, sur la mise à prix du montant d'une année de fermage.

Elle se fera au rabais.

Toutefois, en cas d'insuccès le Conservateur ou son délégué pourra, s'il le juge convenable, faire procéder séance tenante à une nouvelle adjudication soit aux enchères soit sur soumissions cachetées.

Lorsque faute d'offres suffisantes l'adjudication n'aura pu avoir lieu elle pourra être remise, séance tenante et sans nouvelle affiches, au jour qui sera indiqué par le Président sur la proposition de l'Agent forestier. Il y sera alors procédé en présence des mêmes fonctionnaires ou de leurs délégués. L'Agent forestier restera libre d'employer l'un des trois modes d'adjudication et s'il y a lieu chacun d'eux successivement dans l'ordre qu'il jugera préférable.

En ce qui concerne les forêts domaniales le Ministre de l'Agriculture pourra, en cas d'insuccès, autoriser l'exploitation des écorces au compte de l'Etat.

En ce qui concerne les forêts des communes et des établissements publics, le Préfet, sur la proposition du Conservateur et l'avis des Maires ou Administrateurs intéresséés, pourra de même autoriser l'exploitation au compte de la commune ou de l'établissement propriétaire puis la vente des produits soit en bloc soit par lots, dans l'une des communes voisines de la situation des bois.

Article 3.

L'adjudication au rabais aura lieu de la manière suivante :

La mise à prix et le taux auquel les rabais devront être arrêtés seront déterminés par le Conservateur ou l'Agent forestier qui le remplacera.

La mise à prix annoncée par le crieur sera diminuée successivement d'après un tarif réglé à l'avance et affiché dans la salle d'adjudication jusqu'à ce qu'une personne prononce les mots : *je prends.*

L'adjudication sera tranchée au taux du rabais dont le crieur aura énoncé ou commencé à énoncer le chiffre lorsque les mots : je prends, seront prononcés.

Si plusieurs personnes se portent simultanément adjudicataires, le lot est tiré au sort, à moins que l'un des preneurs ne réclame les enchères. Le concours est alors ouvert entre les preneurs.

Article 4.

L'adjudication aux enchères sera faite après l'extinction de trois bougies allumées successivement. Si pendant la durée de la dernière de ces trois bougies il survient des enchères, l'adjudication ne pourra être prononcée qu'après l'extinction d'un dernier feu, sans enchère survenue pendant sa durée.

Les enchères ne pourront être moindres du vingtième de la mise à prix si celle-ci est de 500 francs et au-dessous, du vingt-cinquième si elle est de 501 à 1,000 francs et du quarantième si elle excède 1,000 francs.

Article 5.

L'adjudication par voie de soumission aura lieu de la manière uivante :

Les soumissions écrites sur papier timbré * devront toujours être remises cachetées et en séance publique. Il n'en sera plus admis après l'ouverture de l'une quelconque de celles qui auront été déposées. L'adjudication sera prononcée par le Président en faveur de l'auteur de l'offre la plus élevée, si toutefois le Conservateur ou son délégué juge l'offre suffisante.

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* MODELE DE SOUMISSION.

DÉPARTEMENT d..................
—
ARRONDISSEMENT d.............
—
FORÊT d..................................

Je soussigné (*Nom, prénoms, demeure......*) après avoir pris connaissance du cahier des charges générales, des clauses spéciales et de l'affiche concernant le fermage des chênes-liège dans le bois domanial (*ou communal*) pour.......années qui commenceront le......et finiront le.... déclare me rendre adjudicataire du lot désigné à l'affiche sous le No.......aux clauses et conditions stipulées dans lesdits cahiers moyennant le prix de (*en toutes lettres*), par chaque année.

Lorsque plusieurs soumissionnaires auront offert le même prix et que ce prix sera jugé suffisant, il sera procédé, séance tenante, à une réadjudication aux enchéres, mais seulement entre les preneurs.

Article 6.

Le fonctionnaire chargé de présider l'adjudication décidera de toute contestation qui pourrait surgir pendant la séance.

Il sera juge de la solvabilité des preneurs. En cas de doute, le président exigera la présentation immédiate d'une caution et d'un certificateur de caution solvables ; à défaut de garanties suffisantes il remettra l'article en adjudication.

Les personnes non domiciliées en France qui voudront prendre part aux adjudications, devront, avant la séance, justifier de leur solvabilité auprés des Receveurs intéressés qui pourront exiger d'elles telles garanties qu'ils jugeront convenable.

Article 7.

La déclaration de command ne pourra être faite que séance tenante.

Si le command a les qualités requises pour être admis et si son mandat est présenté immédiatement par l'adjudicataire, l'acceptation de command ne sera pas nécessaire ; mais si ce dernier n'a pas donné de mandat il sera tenu d'accepter par le procès-verbal même d'adjudication et séance tenante.

La déclaration de command et l'acceptation étant insérées dans le procès-verbal ne donneront lieu à aucun droit particulier.

Article 8.

Les minutes des procès-verbaux d'adjudication seront rédigées sur papier visé pour timbre et signées sur le champ par tous les fonctionnaires présents et par les adjudicataires ou leurs fondés de pouvoirs, et dans le cas d'absence ou s'ils ne veulent ou ne peuvent signer, il en sera fait mention au procès-verbal.

Article 9.

Chaque adjudicataire sera tenu, sous les peines portées par l'article 24 du Code forestier, de donner, dans les cinq jours qui suivront celui de l'adjudication une caution et un certificateur de caution reconnus solvables, lesquels s'obligeront solidairement avec lui à toutes les charges et conditions de l'adjudication, seront notamment soumis comme lui à l'obligation d'élire domicile au lieu d'adjudication, à défaut de quoi tous actes postérieurs leur seront valablement signifiés au secrétariat de la sous-préfecture.

Article 10.

Les cautions et certificateurs de cautions seront reçus :

Du consentement du Receveur des Domaines pour les bois domaniaux ; pour les bois des communes et des établissements publics du consentement des Maires et des Receveurs de ces communes et des Administrateurs et Receveur de ces établissements publics.

Les actes y relatifs seront passés au secrétariat du lieu de la vente et à la suite du procès-verbal d'adjudication.

Faute par l'adjudicataire de fournir les cautions dans le délai prescrit, il sera déchu de l'adjudication et une adjudication aura lieu à sa folle enchère dans les formes ci-dessus déterminées et suivant les conditions spécifiées par l'article 24 du Code forestier.

L'adjudicataire déchu payera :

1° La différence entre le montant des annuités cumulées de son adjudication et le montant correspondant résultant de la réadjudication.

2° Les frais de la première adjudication

Calculés à raison de 1 60 % d'une annuité, s'il s'agit de bois domaniaux,

arrêtés par le Président de la vente, s'il s'agit de bois des communes et des établissements publics.

TITRE II.

Du prix des fermages, des frais d'adjudication et des droits de timbre et d'enregistrement

Article. 11

Outre le prix principal de l'adjudication, il sera payé

Par les adjudicataires dans les bois domaniaux ;

1. 1 60 °/o du montant de l'adjudication[1] tant pour les droits fixes de timbre et d'enregistrement des procès-verbaux et actes relatif a l'adjudication que pour tous autres frais.

Par les adjudicataires dans les bois indivis entre l'Etat, les communes et des établissements publics, et par les adjudicataires dans les bois des communes et des établissements publics,

Les droits fixes de timbre et d'enregistrement du procés-verbal et des autres actes relatifs a l'adjudication.

Chaque adjudicataire paiera de plus les droits proportionnels d'enregistrement sur le montant total des annuités du bail augmenté :

1° de la valeur totale des charges,

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(1) Le montant de l'adjudication se compose du prix principal en numéraire augmenté de la valeur moyenne annuelle des charges

2° et du 1 60 % représentant les frais et droits fixes (bois domaniaux) ou des droits fixes de timbre et d'enregistrement des actes antérieurs et postérieurs à l'adjudication (bois domaniaux, indivis et communaux).

Article 12.

Les adjudicataires verseront immédiatement après la réception des cautions :

Pour les bois domaniaux.

Le 1·60 °/₀ et les droits proportionnels dans la caisse soit de l'enregistrement soit des domaines.

Pour les bois indivis entre l'État et les communes et les établissements publics.

Le dixième de la portion de la première annuité afférente aux communes et aux établissements publics, sur le prix principal d'adjudication, dans la caisse du receveur de la commune ou de l'établissement public.

Les droits fixes et proportionnels de timbre et d'enregistrement dans la caisse du receveur soit de l'enregistrement soit des domaines.

Pour les bois communaux et d'établissements publics,

Le dixième du prix principal d'adjudication dans la caisse du receveur de la commune ou de l'établissement propriétaire.

Les droits fixes et proportionnels de timbre et d'enregistrement dans la caisse du receveur soit de l'enregistrement soit des domaines.

Article 13.

Le prix principal du fermage sera payable chaque année, en un ou plusieurs termes dont l'échéance et le montant seront indiqués dans les clauses spéciales, savoir :

Pour les bois domaniaux : à la caisse du Receveur des Domaines.

Pour les bois indivis : à la caisse du Receveur des Domaines pour la part revenant à l'État, et à la caisse du Receveur des communes ou établissements publics pour la part revenant à chacun d'eux.

Pour les bois communaux et d'établissements publics, à la caisse du Receveur de la commune ou de l'établissement public.

Pour les bois indivis et pour les bois des communes et des établissements le dernier versement relatif à la première annuité sera diminué du dixième qui aura été payé comptant.

Article 14.

En cas de retard de paiement les intérêts courront de plein droit sur le pied de cinq pour cent par an, à partir du jour de l'exigibilité des sommes dues.

Article 15.

Le parterre des fermes, comprenant les lieux de dépôt occupés sur le sol forestier ne sera pas considéré comme le chantier ou le magasin des adjudicataires, et les produits qui s'y trouvent déposés pourront par suite être retenus, en cas de faillite, conformément aux dispositions de l'article 577 du Code de commerce.

Article 16.

Dans les dix jours de l'adjudication et apres l'acquittement des sommes spécifiées à l'article 11, il sera délivré par le secrétariat du lieu de l'adjudication, savoir :

1° A l'adjudicataire, une expédition du procès-verbal de son adjudication, un exemplaire du cahier des charges générales et des clauses spéciales, le tout sur papier visé pour timbre ;

2° A l'inspecteur chef de service, une expédition, sur papier libre, du procès-verbal précité ;

3° Au Conservateur et au Préfet, mais seulement quand la vente n'aura pas été faite au chef-lieu de la Préfecture, un extrait dudit procès-verbal.

4° Aux receveurs intéressés, chacun en ce qui les concerne, une expédition du procès-verbal, un exemplaire du cahier des charges générales et des clauses spéciales le tout sur papier visé pour timbre.

TITRE III.

Exploitation et Jouissance.

Article 17.

A moins de stipulation contraire dans le procès-verbal d'adjudication l'adjudicataire sera tenu d'avoir un garde-vente.

Le garde-vente ne pourra être parent ou allié du garde du triage ni des agents de la localité. Il devra être agrée par l'agent local au début de chaque année d'exploitation.

Il sera tenu, toutes les fois qu'il en sera requis de représenter son registre aux agents forestiers pour être visé et arrêté par eux.

Il devra inscrire sur ce registre jour par jour, et sans lacune la mention des arbres démasclés, montés, levés et montés en même temps et cela séparément pour chacune de ces catégories.

Article 18.

Le permis d'exploiter sera délivré par l'agent forestier chef de service sur la présentation des pièces dont le détail suit :

1° Les certificats constatant que l'adjudicataire a fait admettre ses cautions, satisfait aux payements exigés par les articles 11 et 12 du présent cahier des charges.

2° L'expédition du procès-verbal de son adjudication.

3° (S'il y a lieu) : L'acte de prestation de serment du garde-vente, le registre dudit garde pour être coté et parafé.

L'agent forestier apposera son visa sur chacune des pièces.

Article 19.

L'adjudicataire remettra le permis d'exploiter au chef de cantonnement et préviendra cet agent du jour où il se propose de commencer l'opération.

Cette notification devra être renouvelée chaque année huit jours au moins avant le commencement des opérations.

Article 20.

Pendant toute la durée de son bail, le fermier aura la faculté de commencer l'écorcement dès l'arrivée de la sève.

Cette opération devra être interrompue à partir du 15 août de chaque année.

La vidange sera terminée le 15 septembre suivant.

Article 21.

Tout adjudicataire qui, pour cause majeure et imprévue, ne pourra achever la vidange au terme prescrit et aura besoin d'un délai, sera tenu d'en faire la demande au Conservateur, sur papier timbré, dix jours au moins avant l'expiration dudit terme.

Cette demande fera connaître les quantités de lièges existant sur le parterre du lot affermé, les causes du retard dans la vidange et le délai qu'il est nécessaire d'accorder. Il sera statué sur son objet par le Conservateur.

L'adjudicataire par le seul fait d'une demande en prorogation s'oblige à payer les indemnités fixées par le Conservateur.

Les délais de vidange courront à partir du 16 septembre.

Dans le cas où les adjudicataires n'auraient pas profité des délais qui leur auront été accordés, ils ne pourront obtenir décharge de l'indemnité fixée que sur un procès-verbal de l'agent forestier local dressé au plus tard le 15 septembre, en registré à leurs frais, et constatant qu'effectivement ils n'ont pas profité du bénéfice de la décision.

Article 22.

Moyennant l'accomplissement des formalités prescrites par l'article 19 l'adjudicataire aura le droit de lever les planches de liège ayant atteint une épaisseur de vingt-trois millimètres sur les neuf dixièmes au moins de leur largeur, mesure prise sur la section transversale soit supérieure soit inférieure et sur les parties saines et régulières.

Le mot planche s'entendra du cylindre complet d'écorce levée sur la circonférence tout entière de l'arbre. La largeur de la planche correspond à la circonférence dévelopée : sa hauteur est la dimension mesurée dans le sens de la hauteur de l'arbre.

Article 23.

Dès l'origine du bail l'adjudicataire sera tenu de démascler les chênes-liège de cinquante centimètres de tour et au-dessus, mesure prise sur écorce, à un mètre du sol. Pendant toute la durée du bail il devra continuer ces démasclages et faire toutes les augmentations nécessaires sur tous les chênes à mesure qu'ils atteindront la dimension indiquée ci-dessus, ou à l'article suivant.

Article 24.

La hauteur totale démasclée à partir du sol ne devra pas excéder le double de la circonférence du tronc mesurée comme il est dit à l'article 23.

Les branches ne seront démasclées qu'à la condition de mesurer au moins soixante centimètres de tour, sur écorce à un mètre de leur point d'attache.

La longueur écorcée sur l'une quelconque des branches ajoutée à celle déjà écorcée sur le tronc, ne devra pas excéder le double de la circonférence du tronc, mesurée sur écorce à un mètre du sol. Toutefois, les dimensions précédemment indiquées pourront, s'il y a lieu, être modifiées par le Conservateur, à l'aide d'une stipulation insérée dans les clauses spéciales.

Article 25.

Aucun arbre ne pourra être écorcé dans une même année, ou dans le cours de deux années consécutives, sur plus de un mètre cinquante centimètres de hauteur, nonobstant l'épaisseur acquise par le liège de reproduction.

Article 26.

Aucun chêne écorcé pendant deux années consécutives ne pourra subir un nouvel écorcement pendant l'année suivante.

Article 27.

Seront poursuivis comme délinquants, les adjudicataires qui auront levé des écorces, démasclé des arbres au-dessous des dimensions fixées ou en dehors des délais fixés par les cahiers des charges, tant générales que spéciales (Article 30 du Code forestier).

Article 28.

Sera passible des poursuites et des peines prévues par l'article 37 du Code forestier, tout adjudicataire qui aura contrevenu aux clauses du présent cahier des charges et notamment aux articles 25 et 26.

Article 29.

L'adjudicataire sera tenu d'enlever, d'après les indications de l'agent forestier local et dans les délais qui lui seront assignés :

1° Les écorces dites *mûres* qui auraient atteint l'âge de 18 ans sans présenter l'épaisseur de 23 millimètres.

2° Les écorces dites *Noires*, c'est-à-dire les écorces éventuellement avariées par suite d'un incendie.

(Ces écorces lui appartiendront sans augmentation de redevance).

L'adjudicataire devra émonder les arbres démasclés au-dessus de la section supérieure de l'écorce, sur une hauteur égale à celle de la portion démasclée ou augmentée.

Immédiatement après la levée, il pratiquera, au couteau, sur la mère, dans le sens longitudinal, parallèlement à l'axe du bois, du haut en bas de la levée, deux ou plusieurs fentes opposées l'une à l'autre, et pénétrant jusqu'à l'aubier.

Article 30.

En cas d'invasion de maladies sévissant sur le chêne-liège, l'adjudicataire sera tenu de prendre toutes les mesures préventives, curatives ou réparatrices, qui lui seront prescrites par les agents forestiers et d'appliquer ces mesures dans les formes et les délais qui lui seront indiqués

Article 31.

A défaut par les adjudicataires d'effectuer dans les délais prescrits les travaux de toute nature imposés par le cahier des charges générales et des clauses spéciales, ces travaux seront exécutés à leurs frais à la diligence des Agents forestiers et sur l'autorisation du Préfet, qui arrêtera ensuite le mémoire des dépenses et le rendra exécutoire contre les adjudicataires pour le paiement, le tout conformément aux dispositions de l'article 41 du Code forestier et sans préjudice des poursuites à exercer, ni des réparations à exiger en exécution des articles 30 et 37 du Code forestier.

Article 32.

Le corps des chênes-liège étant expressement réservé, l'adjudicataire qui les aurait abattus ou fait périr par un démasclage abusif, qui aurait arraché ou mutilé soit le bois soit la mère, sera passible des peines et réparations portées par l'article 34 du Code forestier.

Article 33.

Si dans les cas prévus par les articles 23, 24, 25, 26, 29 et 30 du présent cahier des charges il y a lieu de réclamer du fermier des dommages et intérêts, le montant en sera réglé par trois experts nommés l'un par le Préfet, l'autre par le Conservateur et le troisième par le fermier.

Si l'expert de l'adjudicataire n'est pas nommé ou n'a pas comparu au jour que le Préfet aura fixé pour procéder à l'expertise, l'opération faite par les deux autres experts sera réputée contradictoire.

La simple signification du procès-verbal des experts obligera l'adjudicataire à verser immédiatement le montant des indemnités fixées, dans la caisse du Receveur intéressé, sous peine d'y être contraint par toutes les voies de droit et notamment celles prévues par l'article 28 du Code forestier.

Les frais d'expertise seront entièrement à la charge de l'adjudicataire.

Article 34.

Par dérogation aux stipulations de l'article 1er du présent cahier des charges, si, dans le cours d'une année, un incendie détruit la forêt sur les trois cinquièmes au moins de l'étendue du lot affermé, l'adjudicataire pourra réclamer la résiliation du bail, mais il n'aura droit à aucun remboursement ni dédommagement destiné à l'indemniser des avances ou des travaux qu'il aura faits, soit de la perte des produits qu'il aurait pu réaliser soit enfin des bénéfices qu'il aurait pu faire.

La résiliation sera prononcée par le Directeur pour une forêt domaniale ou indivise, et après avis du Préfet pour une forêt communale ou d'établissement public.

Le bail restera en vigueur jusqu'au jour où la résiliation sera notifiée à l'adjudicataire.

Celui-ci, pour être admis à résilier devra fournir la preuve que l'incendie ne provient ni de son fait, ni de celui des ouvriers et qu'il en à combattu la marche par tous les moyens à sa disposition.

Nonobstant la résiliation prononcée l'adjudicataire continuera à encourir les responsabilités édictées par les articles 45 et 46 du Code forestier jusqu'à ce qu'il ait obtenu la décharge d'exploitation. Dans le cas où l'adjudicataire renoncerait à la résiliation il pourra réclamer pour les annuités restant à courir une diminution du prix de son fermage proportionnelle à la diminution des produits à récolter. L'évaluation en sera faite par trois experts, comme il a été dit à l'article 33. Les annuités déjà versées et les travaux exécutés resteront acquis au propriétaire qui dans aucun cas n'aura de remboursement à effectuer.

Article 35.

L'État, les communes et les établissements propriétaires des bois dans lesquels l'écorcement du liège est affermé se réservent de faire dans les mêmes bois toutes les ventes d'arbres ou autres produits généralement quelconques, toutes exploitations et tous travaux, en un mot de prendre toutes mesures ayant pour objet la mise en valeur, l'amélioration de la forêt, en général, la culture des diverses essences, la protection des massifs contre l'incendie ou tout autre fléau et contre les animaux nuisibles ; le tout, sans que le fermier puisse réclamer aucune indemnité, restitution, ou réduction de bail pour les chênes-liège ou recépés ou abattus, ou endommagés soit par suite des travaux, soit par la chute des arbres vendus.

Article 36.

Si des chênes-liège sont renversés par les vents ou viennent à sécher sur pied, ou seulement à dépérir, le fermier sera tenu d'en donner avis à l'agent local qui prendra ou prescrira telles mesures qu'il jugera nécessaire.

Article 37.

Il est interdit aux adjudicataires, 1° de faire ou de laisser paître les animaux de trait ou de bât dans les forêts, 2° de les conduire dans le lot affermé sans les avoir muselés préalablement.

Article 38

La vidange s'opèrera par les chemins désignés dans le procès-verbal d'adjudication ou le cahier des clauses spéciales.

Toutefois, dans le cours du bail, le Conservateur pourra désigner d'autres chemins de vidange à l'adjudicataire sur sa demande et celui-ci sera tenu par le seul fait de cette demande de payer l'indemnité qui serait mise à sa charge, à moins qu'il ne renonce au bénéfice de la décision.

Article 39.

Les laies séparatives des coupes, les tranchées et sentiers garde feu seront tenus constamment libres.

Article 40

Sont obliges les adjudicataires

1° à tenir les chemins libres dans la forêt de manière que les voitures puissent y passer librement en tout temps

2° à réparer les ponts, ponceaux, murs, bornes barrières, poteaux, sangsues, glacis, fosses, etc endommagés ou détruits par le fait de l'exploitation ou de la vidange des produits

Article 41.

Les adjudicataires (dans les bois de l'État) seront tenus de payer aux communes les subventions spéciales auxquelles celles ci ont droit en execution de l'article 14 de la loi du 21 mai 1836 et de l'article 11 de la loi du 20 août 1881, pour degradations extraordinaires causées aux chemins vicinaux et chemins ruraux par le transport des produits de leurs lots.

Article 42

Toutes les dispositions du présent cahier des charges sont de rigueur, aucune d elles ne pourra être réputée comminatoire Sous la réserve des dérogations qui pourraient être apportées par les clauses spéciales aux articles 2, 24, 25, 26, et 34, toutes les dispositions précitées recevront leur entière application et ce jusqu'à ce qu'il en ait eté autrement ordonné.

Les fermiers des écorces de chênes liège seront soumis et se conformeront, quant au surplus, à toutes les dispositions du Code forestier et à celles de l'ordonnance du 1er août 1827 qui concernent les adjudications des coupes de bois, notamment aux dispositions des articles 45 et 46 du Code forestier.

Delibéré en Conseil d'Administration le 27 octobre 1886.

Les Inspecteurs Généraux des Forêts,
Signé PETITON.—Signé SÉE —Signé SERVAL.
Signé MANGIN —Signé NIEPCE —Signé LECOMTE.

Le Secrétaire du Conseil,
Signé DAUBRÉE.

VU ET ADOPTÉ.
Paris, le 27 octobre 1886,
Le Directeur des Forêts,
Signé H. GABE.

APPROUVÉ
Paris, le 3 novembre 1886,
Le Ministre de l'Agriculture,

G I C P O,—No 176 R A.—30-4-97 —600—Jos C.

APPENDIX SERIES

OF THE

Indian Forester,

REPORTS BY

E. E. FERNANDEZ, Esq.

Consr. of Forests.

PART II

PART II.

REPORT ON TOUR IN FRANCE.

1. Fire-prevention and the Forest of the Esterel.
2. The Gurnaud System of treating and working forests or the so-called *Méthode du Controle.*
3. The present system of Working Plans in France.
4. Forest Management in a backward part of France; "*Inspection*" of Bagnères de Luchon, Pyrenees.
5. As above, Savoie.
6. Special investigation of Facts and Phenomena connected with the growth and maintenance of Forests. Establishment of Research Bureaux in Germany, Austria, Switzerland and France.

I.—FOREST OF L'ESTEREL AND FIRE CONSERVANCY IN FRANCE.

This forest is situated about 5 miles to the North East of Fréjus and about 10 miles west of Cannes. It comprises 16,664 acres, of which about 1,700 acres are more or less blank or contain only worthless bushes. The entire area is situated on a chain of hills, between 300 and 1,800 feet above sea level, and it is nowhere distant more than 12 miles from the sea. The soil is generally sandy and dry, the underlying roke being sandstone or limestone and often coming up to the surface. The cluster pine constitutes the greater portion of the stock. Cork oak is abundant, but as the working plan is based on the avowed intention of producing timber at every point, the oak is being rapidly pushed out by the pine and the existing trees have no chance of ever yielding the quantity and quality of cork that could be expected from them.

The revenue of the past five years has been as follows :—

Items.	Francs.				
	1890.	1891.	1892.	1893.	1894.
Cork	17,830	24,864	21,715	13,713	16,716
Other produce	310	419	342	303	60
Total .	18,140	25,283	22,057	14,015	16,776
= £ .	725-12-0	1,011-6-5	882-5-7	560-12-0	671-0-10

During these five years the yield of cork was respectively 69,949 95,830, 92,592, 52,256 and 78,959lbs., the gross prices per lb. realised being respectively 9·8, 9·5, 9·0, 10·1 and 8·1 farthings, with a generally falling tendency, which is seen more clearly from the net prices (after deduction of all working expenses) which were respectively 7·8, 8·2, 7·3, 7·0 and 6·3 farthings.

The protective establishment consists of—

		Francs.	Francs.
Brigadiers . .	1 belonging to class II . .	1,200	
	1 " " " III . .	900	
			2,100
	Francs.	Francs.	Francs.
Beat guards . .	6 at 800	4,800	
Gardes cantonniers .	3 at 800	2,400	
	9 at 700	6,300	
			13,500
		Total .	15,600
			= £ 624

Besides the above there is the Range Officer who may be an Inspecteur Adjoint, a Garde Général or a Garde Général Adjoint, drawing various rates of pay and allowances according to his grade.

Under the other heads the expenditure during the past five years has been as under :—

Year.	FRANCS.				
	1890.	1891.	1892.	1893.	1894.
Exploitation of cork . .	3,695	3,235	4,172	4,175	3,684
Roads and paths . . .	12,610	12,500	12,500	12,500	12,500
Buildings	2,219	?	1,681	877	833
Attentions to cork oak . .	3,195	1,528	535	1,832	2,577
Sowing and planting . .	5,403	?	3,941	3,970	2,687
Protection against fire . .	11,954	9,800	9,634	28,633	2 ,404
Miscellaneous	864	864	864	864	1,045
Total .	39,970	?	33,327	52,851	46,690
= £ .	1,598-16-0	?	1,333-1-9	2,112-0-7	1,867-12-0

Thus during the past five years there has been an average annual deficit of £958 (13¾*d.* per acre) without counting the pay and allowances of the Range Officer and the share of the expenses of the Divisional and Conservator's Offices, the addition of which would increase the deficit to over £1,100 or about 16*d.* an acre. This proves beyond dispute the mistaken policy (happily corrected, as I have shown in the case of the Communal Forest of Pierrefeu, by the courage and energy of the Divisional Officer)* of sacrificing the production of cork to an illusory production of timber. The word "illusory" is not too strong a term to use, for reference to the figures given on page 3 for the revenue will show that all sources other than cork gave, during the five years, only an average of £11½ per annum for an area exceeding 16,000 acres. The pine is all young, hardly out of the stage of small poles, so that before they are able to yield timber a long interval of time must elapse, during which the deficits will go on accumulating at compound interest up to an appalling figure. It seemed to me also that the pines required thinning very badly. The present close growth is hence good neither for the pine nor for the oak.

I have already drawn attention to the happy mixture of the cluster pine and *Quercus occidentalis* (as good as, if not a better producer of cork than, *Q. Suber*) in the Landes of Gascony (see Report on the Resin Industry in France); but there the pine is always kept heavily thinned, with the result that while the pines yield abundant resin and grow rapidly, the oak contributes its full quota of bark of high quality. The climate of the Esterel is not less warm than that of the Gascon Landes, the sea here, as there, almost borders the forest, and the dry stony slopes of the Esterel ought to be no less favourable for the production of resin than the sands of the Landes. Thus every circumstance points to the advisability of heavy thinnings in the Esterel, whereby timber dimensions may be rapidly attained, the production of cork increased both in quantity and quality, and the revenue swelled by a considerable yield of resin. Hence, what is urgently required is to radically change the present working plan.

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* See Part I, Report on Forest Industries, p. 121.

The forest is provided with a most complete network of roads and paths (see p. 4).

There are nine dwelling houses for guards and their families. Of these nine two are built on a special plan, so that while there is complete accommodation for two guards and their families on one side, at the other end are two rooms on the ground floor, two on the first floor and one in the attic for the sole use of forest officers when on tour. All these five rooms are most comfortably furnished and supplied with crockery, cutlery, plate, glass, linen and every other requisite except wearing apparel. No rent is charged, however prolonged the occupation. The cost of each of these two houses, exclusive of furniture and fittings, was 30,000 francs = £1,200.

The forest of the Esterel is famous as being the one forest in France to protect which from fire the most elaborate measures are taken, and in this respect it is held up as the model for the whole country. I will therefore enter into some detail in describing the system of protection adopted.

THE SYSTEM OF FIRE-PROTECTION.

The earliest measures in this direction were taken only in 1869, so that we in India have the honour of priority by several years. These first measures were limited to clearing lines round and through the forest by sweeping away all leaves and vegetable débris and pulling up by the roots all low vegetation, whether herbaceous or woody. When fires occurred, they were either attacked directly from all sides, or if there was no hope of overcoming the conflagration in this way, counter-firing was resorted to.

The system has been gradually elaborated until it now comprises the following measures:—

I. *Clearing Traces.*—These are still cleared in the way just described and the expense is hence very high, being from 70 to 102 francs per hectare (= 22·7 — 33*s.* an acre) for first clearing, and from 30 to 70 francs per hectare (= 9·7 — 22·7*s.* an acre) for subsequent clearings. On account of the great cost the traces are not cleared annually, but once every 3 to 5 years. Their present extension is as under:—

		Width. Metres.	Length. Miles.	Area. Acres.
(*a*)	Along spurs and ridges . . .	10, 20 & 30	44·4	338·2
(*b*)	„ boundary of forest . . .	10 & 20	29·4	174·5
(*c*)	„ roads and paths. . . .	20 & 30	34·1	279·2
(*d*)	„ lines dividing blocks . . .	10	4·7	15·5
	„ „ „ compartments .	5		
	„ „ „ sub-compartments .	2½		
		TOTAL .	112·6	807·4

The total length of roads and paths is as follows :—

(i)	Roads with drains .	width 10-12 feet .	length 39·4 miles	}	223·8 miles.
(ii)	„ without „ .	„ 6½-8 „ .	„ 65·2 „		
(iii)	Inspection paths .	„ 2½-3½ „ .	„ 119·2 „		

Besides the above, several miles of a National Road run through the forest. It will thus be seen that traces are cleared along only about one-seventh of the total length of the roads and paths, which are themselves for the most part as good as the specially cleared traces themselves. The work of clearing the traces is carried on continuously throughout the year.

II. *Clearing the ground under the forest of brushwood, shrubby growth and weeds.*—This work, locally termed *nettoiement* (weeding, cleaning), is done with the object of leaving on the soil as little as possible of combustible matter and low bushy growth to favour the spread and intensity of a conflagration. Shrubby vegetation always helps the fire to rise up high into the crowns of the trees. The cost of the operation, when undertaken for the first time in an area, varies between 35 and 40 shillings per acre; when repeated before the ground is again completely overgrown, it amounts to 6½ — 9 shillings. It is evident that so elaborate and costly an operation cannot be spread over any considerable area each year ; it is usually limited every year to about 50 acres taken up for the first time and to 200 — 500 acres that have been cleaned out a few years previously. Obviously the places where the undergrowth is thickest and comes up rapidly are those where it is most wanted. It is often, for the sake of economy and convenience, combined with another operation, *viz.*, the special clearing effected under and round cork oaks to protect the bark from all risk from fire and to expose them to more light, an operation designated "Attentions to Cork Oak" in the table of expenditure given on page 2 above and costing £6 — 7 per 1,000 oaks taken in hand for the first time and about £3 per 1,000 that have been cleared round before. Like the clearing of the traces, the operation described in this paragraph is carried on during all seasons of the year.

III. *Petits feux or special firing of the low growth.*—Scattered patches of one or two acres are fired from December to February with the object of preventing an accumulation of pine needles and other combustible matter, and of keeping down the growth of weeds and brushwood. In this way the entire area is gone over in the course of a few years. At some points the flames rise high enough to char pine stems up to ten feet, but I saw none that had been thereby killed. The operation seems to be successful in keeping the ground fairly clean, and the growth of the pines continues to be rapid (often ⅜ inch in diameter a year); but, on the other hand, it must be remarked that the soil is very rocky and dry and by its nature unfavourable to a rank growth of weeds and underwood. At any rate this special firing makes the work of controlling and extinguishing conflagrations an easymatter.

IV. Establishment of posts of observation.—The most important of these posts is on Mont Vinaigre, the highest peak of the chain, whence there is an unobstructed outlook over the whole forest, and where a hut and stone tower have been built for the purpose. The post is manned from 15th—20th June to 30th September, by 3 fire guards paid at the rate of 2*s.* 3*d.* a day. One man is always on the tower, the three guards taking their watches in turn for 6 hours at a time. Thus each man has to keep two watches every third day. Only 10 hours are allowed for sleep, meals and rest, the balance of the 14 hours not spent on the watch being employed on works, such as planting, road-making, etc. The post is connected by telephone with the house of the Brigadier, who must be informed immediately fire is observed, whether it is believed to be outside or inside the forest.

Another post of observation, consisting of two men, is stationed at Capereaux, near Gratadis at the opposite end of the forest, during the dangerous season, the duration of which of course varies with the character of the year.

The two preceding posts are manned every year. In case of necessity two more posts, one at Trois Termes, the other at Tiayas, may also be established, with two men each, during the dangerous part of the fire season. At these two posts and at that at Capereaux the men relieve each other every 6 hours and have nothing else to do, so that they have 12 hours interval every day for meals, sleep, rest, etc. They also are connected by telephone with the Brigadier of the Sub-Range.

V. Entertainment of additional establishments for patrolling.—During the whole fire-season every beat-guard is allowed a help, appointed by himself and sharing his duties, so that each man has thus only half the beat to patrol. And during the dangerous part of the season each guard as well as his help can have the assistance of one or more workmen in order to ensure ceaseless partolling day and night, while leaving the beat guard free to be near his telephone. The *cantonniers*, or guards in charge of special works, are required to patrol along certain lines, besides directing the work of their gangs. Immediately after a good fall of rain the beat guards must, on their own authority, dismiss their helps.

The Brigadiers fix the hours for patrolling, without reference to the Range Officer.

The Brigadiers and Beat Guards have to submit a special diary in the following form:—

Date.	Manner of employment.	Time spent on such employment.	Compartments or blocks in which employed.	Distance of such place from guard's dwelling.	Number of workmen employed.	REMARKS.

VI. Special detailed rules for the guidance of the Establishment.—A set of most elaborate rules has been laid down for the guidance of the

Brigadier and his subordinates. I need give below the substance of only a few of them

Beat Guards are to constantly occupy themselves with fire conservancy and to keep a look-out from high points.

During the prevalence of the *mistral* or other strong winds patrolling is to be given up and watch kept from elevated stations. By the men taking turn about, the watch to be ceaseless day and night.

During the dangerous period of the fire-season no one may leave his beat, etc., without special leave.

Every one should always carry about with him an axe, bill-hook or spade

Water butts, full, ought always to be kept at hand to supply water to workmen in case of a conflagration.

On a conflagration being observed, whether inside or outside the forest, every one is to hasten to it. If the fire is found to be at least 2 hours' walking distance from the edge of the forest, a sufficient number of men being left near it to meet every eventuality, the rest must return to their respective posts or beats.

In addition to the forest subordinates and workmen, men requisitioned from the adjoining villages should also be taken out to the scene of the conflagration and placed under the direction of some forest subordinate whose orders they are to obey without question.

Every one going to extinguish a fire should take out with him a water bottle and some provisions. In case the fire takes some time to put out, wine and eatables must be procured by requisition from the villages.

Forest subordinates and workmen are to give help in putting out fire also in private forests, the former in order to direct operations and secure order and systematic working. In such forests Government servants may light counterfires only with the previous permission of the owner, when it is certain that such counterfires will involve a large sacrifice.*

Expenditure.—During the past five years the expenditure on fire conservancy under the three great heads has been as follows :—

POUNDS STERLING.

Year .	1890.			1891.			1892.			1893.			1894.		
Clearing traces and effecting *nettoiements* and *petits feux* . .	334	19	0	300	7	1	293	7	4	1,051	7	6	844	3	7
Helps for beat guards	32	0	0	32	0	0	32	0	0	32	0	0	32	0	0
Other establishments and extinguishing conflagrations . .	111	4	0	60	0	0	60	0	0	61	18	10	60	0	0
Total .	478	3	0	392	7	1	385	7	4	1,145	6	4	936	3	7
Average per square mile	18	6	10	15	1	1	14	15	8	43	19	5	35	18	11

See also Appendix, p. 8.

Telephonic Communication.—There is of course only a single wire, the total length of which is 26·7 miles. Instruments are fixed at eight stations in the forest, *viz.*, Malpey and Gratadis, both head-quarters of brigadiers, and Trois Termes, Duchesse, Travas, Malvalette, Mont Vinaigre and La Louve, while the two brigadiers' head-quarters are connected with the Range Officer's office at Fréjus. I have not been able to ascertain the cost of construction and installation, but the maintenance is in the charge of the Telegraph Department, which receives 12 fr. a kilometre (=a total annual sum of £20-13-8) for the purpose. Communication is so perfect that within a few minutes after the discovery of a fire every one concerned, including the Inspector at Toulon and the Conservator at Nice, is made aware of it, and if the aid of the military is required, several companies of soldiers, requisitioned through the Préfêt, are on the spot in a few hours after the summons has gone forth from the Range Officer in the forest. The telephones also make work easy and cheap, by rendering rapid combinations possible whenever men from different beats are required to co-operate.

Conflagrations.—A statement is given below containing summary particulars of the fires that have occurred since 1876. It was from the close of 1877, after the great conflagration of that year, that measures for protection began to be perfected. It is interesting to note, firstly, now successfully the rapidity of progress of a conflagration has been once for all checked by the present measures, and, secondly, how quickly the fires are attacked and got under.

Application to India.—We are so far ahead of the French or, for the matter of that, of every European country, in the matter of protection against fire, that there are but two points in respect of which we may draw instruction from the forest of the Esterel.

The first is celerity of intercommunication. In our more valuable forests telephonic communication would be established with great advantage, not only for fire protection, but also for the conduct of general administration.

The second point is connected with the difficulty hitherto experienced in protecting our pine forests in the Lower Himalayas. A system of *petits feux*, undertaken with the greatest precautions possible, might be tried experimentally in some of the blocks near Ranikhet.

Statement of fires that have occurred in period 1877—1898.

Year.	Number of fires.	Area burnt	Estimate of damage done.	Duration of fires.	REMARKS.
		Acres.	£	Hours.	
1877 . .	...	4,201	25,000	150	
1878 . .	...	...	..	...	
1879 . .	...	...	...	...	
1880 . .	...	...	...	...	

***Statement of fires that have occurred in period 1877—1893*—contd.**

Year.	Number of fires.	Area burnt.	Estimate of damage done.	Duration of fires.	Remarks.
		Acres.	£	Hours.	
1881 . .	...	...	...	...	
1882 . .	1	22	100	1½	
1883 . .	1	2½	1½	7	
1884 . .	1	¾	1¼	2	
1885 . .	...	...	...	...	
1886 . .	...	...	...	...	
1887 . .	...	...	...	...	
1888 . .	1	10	6	1	
1889 . .	...	...	...	...	*N. B.*—The months in which fires are most liable to occur are May-June to November.
1890 . .	1	11	8	3	
1891 . .	3	4½	3	?, 4, ?	
1892 . .	1	1½	...	2¼	
1893 . .	1	½	...	1	

APPENDIX.

For the protection of the forests in the region of the ***Maures et l' Esterel*** against fire a special law has been passed, the main provisions of which are as follow :—

1. During June, July, August and September the use of fire in connection with forest or agricultural work is forbidden in private forests or on any other private land within a distance of 200 metres(=218 yards) of all woods, forests or waste land covered with scrub (*bois, forêts ou landes peuplées de morts-bois*).

2. Nevertheless forest subordinates have the power, acting in the name of the Conservator of Forests, to authorise during the whole or part of the above period, the establishment of charcoal kilns, workshops, etc., but in the event of a fire occurring, the person so authorised will be liable to pay damages.

3. The establishment of charcoal kilns, etc., is permitted at all other times of the year, without prejudice, however, in case of fire, to punishment and to payment of compensation in accordance with section 458 of the Penal Code.

4. Certain discretionary powers are given to préfêts, whereby their administrative orders given conformably with the law in question have the force of law.

II. THE SO-CALLED MÉTHODE DU CONTROLE OR THE GURNAUD SYSTEM OF HIGH FOREST AND OF COPPICE TREATMENT.

M. Gurnaud, an ex-member of the French Forest Department who has had to sacrifice his official position to his professional zeal and inventiveness, has not been happy in naming his system; for, in the first place, the name implies that control of working and management is absent in every other system of forestry, and, in the next place, it creates the idea that his system is concerned only with working plans, whereas really and essentially its scope is sylvicultural.

The system of successive regeneration fellings, passing uniformly over the entire area of a crop, introduced from Germany by Parade, found at once in France more enthusiastic adoption than in the country of its birth, where its shortcomings were not long in being felt and recognised. The far milder climate of France gave it a better chance of success, or at least concealed for a longer time its capital defects, *viz.*:—its failure to secure the natural regeneration, in the desired proportion, of certain species in mixed woods, its total unsuitability for the reproduction and maintenance of the silver fir, its helplessness against violent winds, and, in nearly every case, the uncertainty and irregularity of the results yielded by it. Another potent cause favoured its acceptance and maintenance as first favourite, and that is the intense love of the French for mathematical symmetry of form and epigrammatic brevity of description. What could be nicer and neater than a system which forced Nature, always inclined to be wayward, to move only along symmetrical lines laid down for her! At the bidding of the forester, the parent trees were to sow the ground immediately on the seed-felling being made, each species appearing in its proper place and in due proportion; the resulting seedlings were to steadily strengthen themselves under the successive secondary fellings until, becoming simultaneously established at every point of the regeneration area, they were to be left to take care of themselves by the final felling; then weeds and inferior species were to be got rid of or kept down by the cleanings; and, lastly, the best individuals, representing in just proportion the various economically and sylviculturally valuable species, were to be quickly induced, by means of periodically recurring thinnings, to attain exploitable dimensions, on which stage being reached the same cycle of operations and phenomena was to be repeated *ad infinitum*. Here was the life history and treatment of every forest compressed into the space of a nutshell and forced to follow the outline of the simplest and only symmetrical geometrical figure, the circle. Hence the tenacity with which French foresters have clung and still cling to the system in question and until about 10 years ago considered disbelief in it, except *in forêts de protection* and on inhospitable mountain sides, as rank heresy.

But, as I have just said, a reaction commenced a little more than ten years ago. It was inevitable, for the results of experience could not be gainsaid. The system had egregiously failed, especially in the extensive silver fir forests, and many forest officers had the courage to declare their conviction of the fact. Among these M. Gurnaud made himself particularly prominent by his unmeasured denunciation of the system in vogue, denunciations which, seeing that the members of the Central Administration in Paris had learnt their profession at the feet of Parade himself, cost him his post in the Department. But what was his personal loss, has proved an immense gain to the forester's art, for being obliged to practise his profession privately, he has had an opportunity of developing his speculations and putting them to the test of experiment. More than 120,000 acres of private woods, situated principally in Franche Comté, Alsace and Switzerland, are already under treatment in accordance with his system, and the results obtained even in this short space of time are so favourable that the proprietors are enthusiastic over it. Meetings of the local agronomic societies, among whose members are numerous forest officers, have made special excursions to some of the forests so treated and, in spite of the bias inevitable on account of Nancy and departmental traditions, have on the whole pronounced favourably on the system. But the greatest triumph that M. Gurnaud has yet scored has been the spontaneous decision of the Central Forest Administration to practically test the merits of his system in an area of State Forest. According to their decree of 15th October 1885 the conduct of the experiment has been entrusted to the *Station d' Expériences* attached to the Nancy Forest School. Regarding this experiment I shall give some details lower down. Before proceeding further I must describe as briefly as possible the system and the principles on which it is based.

The first thing that struck M. Gurnaud in considering the system of uniform successive regeneration fellings was the separation on the ground of the various age-classes. We are all aware that in order to produce less than a hundred trees of exploitable dimensions per acre we begin by covering the ground with more than five hundred times that number of seedlings. Would not a much smaller number of seedlings, M. Gurnaud asks, suffice? He at once answers, yes, and so must every one else. But, say the advocates of a separation of the age-classes, "You must grow trees in masses in order to obtain long, clean, straight, well-shaped boles and the full rate and total amount of height increment. Hence the intervals between the future individuals of the mature crop must always be occupied by others, doomed though they are to premature disappearance by death or at the hands of the woodcutter." To this M. Gurnaud replies that trees can be grown in masses without all being of one and the same age. The old jardinage, defective though it was, produced tall timber of good quality. If a large proportion of the trees were branchy or canker-stricken, it was because the jardinage, owing to the absence of roads and bad markets, was not intensive enough.

Thus M. Gurnaud's contention that a separation of the various age-classes necessarily involves giving up too much of the area to the younger classes is unquestionable. The excess area occupied by any particular age-class is in inverse proportion to its age. One acre of nursery gives enough of seedlings to plant up *completely* at least 100 acres, and much more than double that area if the ground has already other and older growth on it; and yet by the distribution of the age-classes over separate plots, the 100-year old trees are given no more share of the total forest area than the 1-year old seedlings which would be satisfied with less than one-hundredth of what they actually get. With the age-classes mixed together the one-year old seedlings would require no special room at all, for in the spaces that must necessarily exist between the older stems there will always be plenty of room for many times more than the number of such seedlings that could ever be required.

M. Gurnaud therefore abandons altogether the separation of the age-classes and adopts a complete mixture of ages. The theoretically correct thing to do would then be to allot to each class a total amount of growing room directly proportional to its age, making due allowance for a certain number of its individuals disappearing until with the progress of time the survivors attained felling maturity. The solution of this problem is however beyond the bounds of possibility and he therefore adopts the following simple rule. He rejects altogether the element of age as being too uncertain a factor, for in a crop of one age the difference between the thickest and thinnest stems may be equal to, and even more than, the diameter of the latter, and a backward stem 100 years old may hardly be thicker than a vigorous one half its age. He therefore constitutes only diameter-classes, and only four of them, *viz.*:—(I) Under 20 centimetres (7·9 inches), (II) 20 to 35 centimetres (7·9—13·8 inches), (III) over 35 and up 60 centimetres (13·8—23·6 inches) and (IV) over 60 centimetres (23·6 inches). For the first of these four classes he makes no special provision, considering that it has ample developing room in the intervals between the stems of the three other classes, which together he maintains in the condition of a somewhat open leaf-canopy. He also leaves the first class out of his estimate of the stock, regarding it only as recruiting material for the upper classes. The relative proportions of these latter (the second, third and fourth classes) he fixes in terms of the amount of stem-wood they contain, which should be as 2 : 3 : 5.

M. Gurnaud invented his system in connection with the working of silver fir forests. It would hence be interesting and instructive to compare the stock contained in a silver fir forest of 150 hectares consisting of one hectare patches of 150 different ages rising from 1 year to 150 years with that in another of the same area, but in which the ages from 1 to 150 years were all mixed up and in which M. Gurnaud's three upper size-classes existed in the relative proportions fixed by him. Unfortunately the yield tables I can use, *viz.*, those of Herr Schuberg, are carried up only to the age of 150 years, at which age the mean diameter attained by the trees is only 55·7 centimetres. But as some comparison is better than none, I have treated Schuberg's largest class as the equivalent of M. Gurnaud's fourth class. This is allowable, because if such comparison proves favourable to the Gurnaud system, much more favourable would be the result if all the terms of the series were available. I have taken the figures for a good soil and locality and for a crop of moderate density. In order to make the conditions as unfavourable as possible for M. Gurnaud's position, I have diminished the area occupied by his three upper classes to 130 hectares, supposing 20 hectares to be necessary for the smallest class. My calculation gives the following results :—

MEAN DIAMETER OF THE STEMS.		AGE CLASSES ON SEPARATE AREAS OF 1 HECTARE EACH.		AGES INTERMIXED AS IN GURNAUD'S SYSTEM.		
Minimum.	Maximum.	Age classes.	Volume of Standing Stock in cubic metres.	Diameter class.	Hectares occupied.	Volume of Standing Stock in cubic metres.
...	20 cent.	45 of the youngest age classes from 1 to 45 years old respectively.	8,324	1	20	Left out of account.
20 cent.	35 „	33 classes from 46 to 78 years old.	24,456	II	26	19,269
35 „	60 „	71 classes from 79 to 149 years old.	79,873	III	39	43,479
60 „	None.	1 class 150 years old ...	1,305	IV	65	84,825
		TOTAL .	113,958	...	...	147,573

The figures in the fourth column have been obtained by interpolating, by a simple rule-of-three sum, volumes for ages between 1 and 5 years, between 5 and 10, and so on, and totalling. The figures in the last column have been worked out from those in column 4 by the rule of proportions thus :—If 33 hectares contain 24,456 cubic metres, how many will 26 hectares contain ? The resulting figure is 19,269 cubic metres ; and so on for the next two figures. This supposes that each of the 33 age-classes which give stems from 20 to 35 centimetres in diameter occupies an equal share of the 26 acres allotted to M. Gurnaud's class II, and so on. The reality would of course be different, for the very essence of the Gurnaud system is that the larger the size class, the larger must be the proportion of space given to it. One more supposition unfavourable for the Gurnaud system has thus been made, in addition to those cited above. To what extent this supposition works against the Gurnaud position will be clearly appreciated by taking a concrete example. Thus, the age-classes included under Gurnaud class II are supposed each to occupy $\frac{26}{33}$ hectares. This would give 1,037 stems 50 years old to only 758 stems 60 years old, implying the disappearance of 27 per cent. of the number of stems in the short space of 10 years in a pretty open crop, an utter improbability save under entirely exceptional circumstances.

Thus, in spite of all the extremely unfavourable suppositions made for the purpose of comparison and argument, the Gurnaud system comes out 29 5 per cent. better than the system of separating the age-classes on the ground. Worked out under conditions equally fair to both sides, the advantage for the former system would exceed 50 per cent.

Up to this the comparison has been limited to the question of amount of material only. If we extend it to the question of yield in money, it becomes still more favourable for the Gurnaud system ; cubic foot for cubic foot the produce of M. Gurnaud's jardinage crops contains more timber and timber of larger girth than the one-aged crops, a very large proportion of the produce of which disappears in thinnings before it has attained anything like exploitable size. If therefore we compare the two systems from the revenue point of view, the advantage in favour of the new one is no longer 50, but nearer 100 per cent.

It may be objected that owing to the mixture of ages the trees will grow up in too great freedom to develop long, clean, straight boles. But objections of this kind are now no longer deserving of an answer after the numerous measurements made in Germany, which have proved once for all that it is not a dense leaf-canopy which produces the tallest trees or favours rapid growth in height. The somewhat open growth of the Gurnaud type of forest not only does not interfere with height increment and the formation of a good bole, but is specially favourable for diametral development, which is after all the most important element in forest economy, particularly when financial considerations are brought into line with the question of merely meeting the demands of the market. In one-aged crops the few trees which are ultimately to constitute the future exploitable crop are constantly during the greater part of the rotation interfered with and kept back by their numerous neighbours of almost equal height and vigour, and it is this circumstance which has led so largely in Germany to underplanting after or just before a very severe thinning which isolates the crowns of the trees (the Plenary Thinning of my Manual of Indian Sylviculture). Here in the mixed-age crops the exploitable trees of the future are free from the very beginning to make all the growth of which they are capable without being exposed to become deformed or branchy, and they therefore attain exploitable girth early.

It will be observed that although what precedes has been said with special reference to high forests, it applies equally well to coppice with standards, the coppice constituting M. Gurnaud's Class I. Indeed, as will be seen lower down, there is very little to distinguish coppice with standards as treated by the Gurnaud system from high forest beyond the wholesale removal of all the lowest class after reservation of what is to form the standards.

An essential characteristic of the system is the frequently recurring exploitations, *viz.*, at intervals of 6—15 years, so that the desired condition of somewhat open leaf-canopy and fixed relative proportions of the diameter classes can be constantly maintained.

To resume what has been said up to this, M. Gurnaud's system is based on—

(1) A complete mixture of ages as the sole condition for the complete utilisation of the area, for absolute certainty of natural regeneration with the desired species, and for safety against climatic accidents.

(2) Entire rejection of a rotation * or fixed age of felling maturity, diameter being made the sole criterion of exploitability.

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* This word has been unhappily chosen in our technology to mean *felling age*. It would have been much better to have allowed it to retain its ordinary meaning of something moving in a circle and hence regularly recurring, *e.g.*, rotation of improvement fellings, of jardinage fellings, etc.

(3) Hence also entire rejection of age-classes and adoption in their place of diameter-classes as follows (suited of course to the circumstances obtaining in the districts where the system has hitherto been applied):—

Class I.—Under 20 centimetres in diameter.

Class II.—From 20 to 35 centimetres in diameter.

Class III.—Over 35 and up to 60 centimetres in diameter.

Class IV.—Over 60 centimetres in diameter.

(4) Constant maintenance of a somewhat open leaf-canopy.

(5) Allotment of standing space to the three largest diameter classes measured by the total amount of stem-wood in them, which should be respectively in the ratio of 2 : 3 : 5, the smallest class being left to shift for itself under the individuals composing the others and in the intervals between them, thanks to condition (1). This rule is framed exclusively with the object of securing just the number of smaller individuals and no more, to recruit the largest diameter-class, so as to give to this last the widest extension possible, thereby obtaining the maximum yield of large timber, and therefore, of money also.

Having explained the principles essentially underlying the Gurnaud method, I will now proceed to show how it is applied.

APPLICATION TO HIGH FOREST.

The rotation for the fellings is fixed at 6, 8 or 10 years, never more, and the compartments of the forest are formed into as many groups of as nearly as practicable equal productive power. If the forest is large, several felling circles are constituted and then it suffices to divide each felling circle into equal or nearly equal coupes, 6, 8 or 10 in number according to the number of years in the rotation; inequalities in yield of the different circles then counterbalance each other sufficiently. Thus ultimately each coupe becomes a compartment, just as in the régime of coppice.

The coupes are worked successively in the order in which they follow one another on the ground.

At the beginning of each rotation a complete enumeration survey is made of all the trees 20 centimetres (8 inches) and over in diameter. Every tree more than 17½ but less than 22½ centimetres in diameter is registered as being 20 centimetres in diameter; every tree more than 22½ but less than 27½ centimetres as one of 25 centimetres; and so on. The quantity of stem-wood in each of these diameter-classes, rising from 20 centimetres 5 centimetres at a time, is then computed from the results obtained from the careful cubing of type stems; and then by addition the quantity of stem-wood in each of the three larger working diameter-classes (Classes II, III and IV described above is obtained. Let this be respectively V_{II}, V_{III} and V_{IV}.

We will suppose that the forest under consideration has been taken in hand for the first time, so that the rate of growth is not known. M. Gurnaud does not waste any time or energy in trying to ascertain it (a more or less insoluble problem under the conditions which he postulates for the future working of the forest), but makes the fixing of the yield of the ensuing rotation a matter of pure discretion.

Here is his method. He assumes a certain moderate figure for the percentage at which the annual increase has been taking place during the immediately preceding 6, 8 or 10 years, as the case may be. Then with the help of these two figures, which we will designate respectively *r* and *n*, and of that expressing the standing stock of stem-wood ($V_{II}+V_{III}+V_{IV}$ = say V_P) he obtains, by means of a simple interest sum, the stock of stem-wood existing *n* years ago, which quantity we will designate V_n

$$= \frac{100V_p}{100+r\,n}.$$

Hence the current annual increment during the past *n* years

$$= \frac{V_p - V_n}{n} = \frac{rV_p}{100-r\,n}.$$

It will be observed that it would be more correct to apply the formula for compound interest, and also to take into account the produce removed during the period in question; but, as will be seen, M. Gurnaud's subsequent use of the increment is such that the rough and ready method of calculation just described gives him all he wants.

If the forest appears complete, the three working diameter-classes are well represented and V_P is large enough, he prescribes for the quantum of the annual fellings the full figure obtained as above for the current annual increment. But almost invariably one or more of the three hypotheses assumed are wanting, and he accordingly reduces the annual yield for the ensuing rotation to some fraction of that figure, two-thirds, one-half, one-third, one-fourth, or even less.

At the end of the first rotation he makes a fresh enumeration survey on the same principle as before. For the first time now he can calculate exactly the mean annual increment during the past *n* years, for he knows the stock standing respectively at the commencement and at the end of that period and the quantity of material cut out in the meanwhile. This time again the condition of the stock may be so far removed from the normal sought as to require the yield during the second rotation being reduced as before. And indeed it may be a good many rotations before it is possible to adopt the full figure of the past mean increment. Nevertheless each successive rotation will find the stock nearer the normal state.

Thus far we have considered a forest that is to be brought into full production; but the above system of fixing the annual yield can be applied just as well and with the same degree of certainty to forests which have also to fulfil other purposes besides supplying wood. For instance, the given forest area may have also to furnish grazing for a certain number of head of cattle; the maximum amount of tree-growth that may be maintained without detriment to the production of the required amount of herbage being known, the annual yield will be less than, equal to or exceed the current increment, according as the existing amount of grazing is more than sufficient, just sufficient or insufficient.

The annual fellings are made in both stories of the crop operated upon. In the upper story, that formed by the three largest diameter-classes, they combine the nature of a regeneration felling and of a thinning, in the lower that of a thinning and of a cleaning. The lower story should be taken in hand only after the work has been finished amongst the trees above, as it is only then that the individuals to cut out or foster can be selected with certainty. Moreover the felling of the overhanging trees invariably injures some of the good stems below, and the lower crop cannot evidently be touched until all fear of such injury is over. In operating in the lower crop there should be no hesitation in removing these injured stems, as well as all brushwood and spreading and defective growth, and in thinning out patches that are too dense. Nevertheless on the pretence of doing this last, promising patches of advanced growth ought not to be interfered with, as it is only advance growth which comes up in patches that is worth anything. In the case of species that coppice, the injured and defective growth, provided the stem is not too thick, should be carefully cut back in order to shoot up again. At the same time as the cutting is being proceeded with, well-placed young individuals should be encouraged to grow up rapidly and straight by means of judicious pruning of side branches, correcting of forked growth, pinching off of superfluous buds, snapping off a too-luxuriant branch, and so on. It should be remembered that only a very few of the numberless individuals of the undercrop can be preserved until they reach exploitable size, and no special attention given to these few can ever be considered wasted labour.

Dead and fallen trees and those cut by offenders should be utilised at once, wherever found, and their volume deducted from the quota of the regular felling when this arrives in due time.

It will have been seen that the Gurnaud system applied to high forests is an intensive jardinage, a jardinage in which the relative proportions of the several diameter classes are strictly regulated, instead of being left to mere haphazard, in which exploitations are not delayed until the trees enter on their decline, and in which cleanings and thinnings are made with not less care and precision than in forests composed of one-aged crops. It has this one great advantage over all other systems that the uncertain element of age is altogether eliminated and exploitability is based exclusively on the appreciation of a concrete fact about which there can be no difference of opinion or chance of error, *viz.*, diameter; and it involves no elaborate, often vain, researches after the rate of growth. In this respect it is at once adoptable in India. The best proof of the utter inapplicability to our forests of any other system but jardinage is the striking fact that in spite of scientific forestry having been introduced by Sir Dietrich Brandis nearly 40 years ago, no other system of high forest treatment has yet been adopted. And even here in Europe a better appreciation of jardinage, suffering though it still is owing to the absurd definition of it admitted into most text books, is becoming general. In France it is now almost universally acknowledged to be the best system for spruce and silver fir, while in Southern Germany the group system, a hybrid, which is however more akin to jardinage than to its other parent, gains in favour every day.

It is constantly asserted against jardinage that it spreads the annual operations over too large an area for effective control and economical working and for prevention of damage by the felling and export of wood. Such an absurdly groundless charge would not be worth answering were it not so universally made even by persons who do not generally form their opinions without proper consideration. That jardinage operations damage the standing growth more than any other system of treatment involving regeneration under cover is completely disproved by the experience gained in Germany in the application of the group method.* It is surely obvious that damage will be greatest where the fellings are concentrated. As regards control of the operations and economy of work it is extraordinary that jardinage should have been charged with spreading its operations over too wide an area. A concrete instance will at once show that it is in forests composed of one-aged crops that the annual operations have the greatest extension. We will take the case of a forest of 100 acres. In the one case (jardinage), even with such a short rotation of fellings as eight years, the area worked over in any year is 100÷8=less than 13 acres; in the other case, 20 years at least are required for natural regeneration and five years at least for a hand-sown or planted crop to be out of danger, so that with 10-year thinnings, the least area worked over in any year is 30 or 15 acres, according as the regeneration is effected naturally or artificially, and then we must not lose sight of the amount of worry and labour involved in fighting insects in one-aged crops regenerated artificially. In many cases in such crops the original crop has a younger one planted under it, thus still further increasing the aggregate area under some kind of operation or other.

It is also objected against jardinage that as regeneration is constantly going on everywhere it necessarily excludes grazing. I admit that it excludes even the idea of grazing, but this not because regeneration is going on everywhere, but because once the forest is complete there is nothing for cattle to graze upon, the constantly unbroken leaf-canopy being fatal to the growth of herbage. As long as the forest growth is incomplete, there is, I confess, always danger to the reproduction. But is this danger after all so very great? As some reproduction is always taking place, it follows that the young growth is of very different ages and sizes, and therefore the amount required in any one year is absolutely small, and, being scattered over the whole area of the forest, entirely insignificant. The case of the forest of

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* See Report on Forestry in Germany, p. 43.

Siegsdorf (see report on Forestry in Germany, pages 34 *et seq.*) is in point. In spite of every portion of the forest being open to grazing, regeneration by the group method is perfectly successful, and yet, barring the concentration of the young growth (a decided disadvantage against grazing) the group system of regeneration does not differ from that under jardinage.

But a more direct and more striking proof is the case of the forest of Le Châlet Brulé, near Besançon, belonging to the Vicomte de Laître and cited by Messrs. Cannon and Gazin, two forest officers, in a printed report submitted by them in 1893. This forest of 988 acres is situated at about 4,000 feet above the sea and has for years been used as a *prés-bois*, that is to say, as an estate managed with the double view of supplying wood and pasturage. Owing to mismanagement the forest had been growing poorer and poorer, the grazing capability at the same time deteriorating to such an extent that the head of cattle admitted was reduced from 100 cows and 50 calves to 60 cows and 30 calves. In 1875 the forest was placed under the Gurnaud treatment. Under this treatment the stock of stems 20 centimetres and upwards in diameter had risen in 10 years from 472 cubic feet to 858 cubic feet per acre (two-thirds of the annual increment being cut every year) and the number of cattle admitted to graze had been increased. M. Gurnaud is trying to work up to a standing stock (of 20 centimetres and larger stems) of 2,600 cubic feet per acre, which he thinks will enable the original head of cattle to be readmitted and maintained permanently.

In the preceding argument I of course exclude the kind of grazing that goes on in many of the forests in the Central Provinces where more than 1,000 head often graze over about 2,000 acres. With such heavy grazing no system of generation could ever succeed in creating a complete forest.

Before passing on to the application of the Gurnaud system to coppice, it will be interesting to note the results yielded by it in high forest in two cases, not chosen because the results are superior to those obtained elsewhere, but because one is that of a silver fir forest and the other of a broad-leaved one in charge of the Research Bureau at Nancy.

The first is that of the portion of the Clairvaux forest belonging to M. Henri Jobez, area 1,762 acres. Originally of silver fir, it was opened out too much by overfelling, with the result that broad-leaved species got the upper hand. But the growth became full once more and silver fir began again to gain the predominance, to which end it was also helped by plantation. From 1858 to 1885 the fellings were limited too exclusively to large trees, so that even unsound and deformed ones of small size were preserved. Nevertheless from 1875 to 1885 the stock of trees 20 centimetres and more in diameter had nearly doubled. Since 1886 the forest has been under M. Gurnaud's treatment, the rotation of coupes being one of 6 years and the yield being fixed at 30 per cent. of the annual increment obtained by means of the usual assumption made at the beginning of the first rotation

Actually however this yield has not been fully worked up to, the desire being to bring the forest into the normal condition as quickly as possible, and accordingly only decaying and otherwise defective trees have been cut out. In 1869, a survey made over 59 acres showed that a mean annual increment of 157 cubic feet per acre per annum had taken place.

The other instance is that of the experimental area of 168 acres in the forest of Champenoux devoted to the strict testing of the system by the special Research Bureau attached to the Nancy Forest School, and to which allusion has already been made on page 10 above. The Forest of Champenoux, situated on low plateau land and on a fairly rich loamy soil, was for centuries treated as coppice with standards. About 30 years ago it was put under a working plan, in accordance with which it is being gradually converted into high forest wth natural regeneration under cover by the method of successive uniform fellings. In 1886 the area in question was detached from the Fourth Periodic Block of one of the Working Circles, but although the enumeration and valuation surveys were made in January 1886, the experiment was not begun until a year later.

The composition of the stock was as follows :—

Oak and ash . . .	In respect of number of stems	40·8 % ;	of volume	61·2 %
Beech	„ „ „	10·0 „ ;	„	10·9 „
Hornbeam and other hard woods	„ „ „	41·8 „ ;	„	23·5 „
Soft woods	„ „ „	8·4 „ ;	„	4·4 „

The standards alone, in point of volume, consisted of 70 per cent. oak and ash, 10 per cent. beech and 20 per cent. hornbeam and others, and although generally numerous, were unevenly distributed.

In December 1892, at the close of the first rotation of 6 years, the composition of the stock was as follows :—

Oak and ash . . .	In respect of number of stems	38·7 % ;	of volume	58·1%
Beech	„ „ „	12·1 „ ;	„	12·2 „
Hornbeam and other hard woods	„ „ „	39·1 „ ;	„	24·2 „
Soft woods	„ „ „	10·1 „ ;	„	5·5 „

In order to calculate the mean current annual increment at the beginning of the first rotation, it was assumed that the rate of growth was 5 per cent. of the stock capital. This gave a mean annual current increment of 17·7 cubic feet of stem-wood per acre. But the working diameter-classes II, III and IV containing only 458 cubic feet of stem-wood per acre, it was considered necessary to fix the annual yield at only one-third of the mean annual current increment (5·9 cubic feet per acre), in order to bring the forest into the normal state as quickly as possible. And as the relative proportions of those classes were only as 46 : 33 : 21 instead of being as 20 : 30 : 50 the normal rate, it was decided that only dead and dying trees and those badly situated should be removed in the fellings, and that if the figure of the annual yield was not thus obtained, the balance was to be taken out of classes II and III alone. But in framing this last prescription a very important fact peculiar to coppice under standards under conversion into high forest was forgotten, *viz.*, the liability of the older standards to premature death the moment they are at all exposed by the felling of surrounding growth.* The result was that the first rotation has left the relative proportions of the three working diameter-classes practically unchanged. Thus the 6 exploitations removed from—

Class II .	388 trees	containing	4,040 c. ft. of stem-wood	leaving the three classes to stand respectively in the ratio of 47 : 32 : 21.
„ III .	53 „	„	1,944 „ „	
„ IV .	14 „	„	1,131 „ „	

Accordingly the relative proportions of the three classes were slightly worse at the end than at the beginning of the rotation. This was of course no fault of M. Gurnaud or his system, but of the wretchedly unpromising bit of forest assigned to the experiment. It was obvious that the Fourth Periodic Block of a Coppice-under-Standards working-circle, under conversion into high forest to be regenerated under cover by the system of successive fellings passing uniformly over the entire area of the year's coupe, would consist chiefly of coppice and standards of the lowest class, the larger trees being mostly the superannuated standards of the previously ruling coppice régime. Consequently it is too early to expect any real results in the short space of 6 years, or even until the superannuated standards have been cleared out and the younger stems have had time to develop, *i.e.*, until one or two more rotations of fellings have passed through the forest.

But apart from the marked unsuitability of the experimental area, the mistake has been made of thinning out far too severely the lower story composed exclusively of the coppice growth and forming Class IV of the Gurnaud system. The thinning has been so severe that all the preserved stems are completely isolated. This mistake has had the double undesirable result of throwing into the market a large proportion of very small and therefore almost unsaleable stuff and of leaving the surviving stems under very unfavourable circumstances for pushing up in height and clearing their lower branches. It is however not a fault of the system, but a mistake in the application thereof and is due to M. Gurnaud's previous experience having been confined principally to conifer forests and hilly regions. He has himself acknowledged his mistake and has laid down for the second rotation total abstention from cutting anything out of the young growth, except what immediately surrounds and keeps back a few vigorous and well situated individuals which are without doubt the exploitable trees of the future. It would, I think, be well if he enjoined this procedure for *all* subsequent rotations. When his classes II, III and IV have been fully or nearly fully constituted, he will find that the condition of the forest will be such that there will never be a dearth of seedlings of the desirable species and that keeping the soil well covered by the lower story will be a necessity for the sound and vigorous development of the trees of the upper story.

In spite, however, of the unfavourable nature of the experimental area and of the mistake of over-thinning the understory, the results obtained have been encouraging as the subjoined statement clearly shows:—

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* This fact was forgotten also by the framers of the working plan for converting the forest of Champenoux into high forest. The old standards maintained in accordance with their prescriptions, in order to constitute as large a proportion as possible of the parent crop for the seed felling, are in full decay long before the seed felling can be made. In this respect alone the working plan is responsible for an enormous loss of both money and material and for sylvicultural difficulties.

PARTICULARS.	IN JANUARY 1896.			IN DECEMBER 1896.			DIFFERENCE OF VALUE.	
	Number of Stems.	Volume (entire trees) in cubic feet.	Money value in shillings.	Number of stems.	Volume (entire trees) in cubic feet.	Money value in shillings.	Increase	Decrease
							Shillings.	
Standards { Stems 20 cent and over in diameter.	5,260	149,813	56,002	6,156	183,643	68,765	12,763	...
Standards { ,, under 20 cent. in diameter.	2,508	8,802	2,590	15,864	30,048	7,757	5,167	...
Coppice or underwood	Left out of account	84,239	16,798	Left out of account	3,676	377	...	16,421
TOTAL .	7,768	242,854	75,390	22,020	217,367	76,899	1,509	..

A comparison of the figures in the third line of the table renders apparent at once the mistake madeof over cutting in the understory. However, the great increase in the number of stems between 5 and 20 centimetres in diameter augurs well for the recruitment of the higher classes during the next two or three rotations. Out of 97 of these stems per acre M. Gurnaud proposes to cut out from 57 to 67 during the second rotation, on the ground that only from 30 to 40 such stems are required to recruit the upper classes. To do so will surely be a mistake, for he cannot expect that stems that are now under 5 centimetres in diameter will attain to anything like a diameter of 20 centimetres in 6 years In view of the poverty of the largest class and of the total insufficiency of the three upper classes taken together, it is without doubt necessary to push up into Class III as many of the 97 stems per acre as possible

Reverting again to a consideration of the results obtained, we find that in the six years of the first rotation the total of stem wood in the three upper classes rose from 460 cubic feet to 568 cubic feet per acre.

As the quantity removed by the fellings during the same period was 44 cubic feet per acre, the mean annual increment was 21 cubic feet per acre or 4·4 per cent. of the original stock of 460 cubic feet, a sufficiently satisfactory figure considering all circumstances. The money-value of the same stock rose similarly from 36,002 shillings to 64,765 shillings the sales having amounted to 4,244 shillings. Hence the mean annual increase in money-value was at the rate of 4·34 per cent. or very nearly the same as the rate of increase in volume. A higher rate than this latter would have been more satisfactory, but was precluded by the premature removal of so large a proportion of the trees of Class IV.

We have still to consider the total yield in material and money obtained. These were respectively 98 cubic feet and 17·2 shillings (gross) per acre per annum. Taken absolutely, the former figure is excellent, the latter, considering the low-class of the produce (principally derived from coppice), is not unsatisfactory. In the rest of the forest from which the experimental area has been detached, and which, as has been already said, is under conversion from coppice with standards into high forest to be regenerated under cover by successive fellings passing uniformly over an entire year's coupe, the corresponding figures have been at the same time 54 cubic feet and 15·9 shillings. The advantage is thus entirely on M. Gurnaud's side. The money difference is very much larger than appears from a mere subtraction of 15·9 from 17·2 shillings, for whereas M. Gurnaud's system has been applied in a portion detached from the 4th periodic or youngest block, in the rest of the forest it is the oldest, *i.e.*, those containing principally timber, which are being felled.

APPLICATION TO COPPICE.

It is evident that the Gurnaud system can be applied only to coppice with standards.

Before formulating his rules M. Gurnaud recalls the following facts:—

1. The highest rate per cent. at which the coppice increases in volume is reached at 10—15 years.
2. The removal of the coppice is immediately followed by accelerated diametral growth of the standards, the acceleration being greater the younger they are, and diminishing rapidly after a certain age has been passed.
3. Excepting those reserved for the first time, the standards attain their maximum current increment in the 7-8th year after the exploitation of the coppice. The former, being younger and therefore more tolerant of shade and contact with other individuals, maintain an increasing rate of growth much longer.
4. A thinning of the coppice a few years before it is again cut over results in a considerable increase in volume for the standards. In the forest of Argançon near Belfort, belonging to M. Jobez, the rate of volume-increment of the standards was quite doubled by a thinning effected in the coppice two years before it was cut.

Starting from these facts M. Gurnaud lays down the following general rules:— Adopt a rotation of not more than 15 years for the coppice fellings; at each cutting reserve 120 per acre of the best well-placed stems of the coppice, of which the greater number (in round numbers 100) should be removed at the next felling; make two or three years before each coppice felling, a light thinning in the underwood, taking advantage of this to set free the crowns of a sufficient number of promising and well-placed individuals of desirable species, such individuals as are likely to be reserved later on as standards; progressively form a reserve of standards consisting of the three usual Gurnaud classes according to the fixed proportion of 2 : 3 : 5; lastly, at each felling of the coppice prune or otherwise trim amongst the younger standards, selected at favourable points, the trees of the future.

Two objections are at once made to the shortness of the rotation, *viz.*, firstly, that height-increment and natural clearing of the bole would be greatly interfered with by isolating saplings not more than 15 years old and therefore only 10-12 feet high with no bole to speak of, and secondly, that the produce of such young coppice would be worth little or nothing.

M. Gurnaud's answer to the first objection is not satisfactory. He says "Use the pruning shears freely on those 40 or 50, or even 60, of the newly reserved 120 coppice stems per acre which by their position are likely to be preserved at the next felling, and at that exploitation you will find at least 20 out of the original 120 straight, clean-stemmed and vigorous." He entirely fences round the main objection, which is loss of growth in height. At each exploitation of the coppice there is a marked slackening in height-development of all the standards, which do not, therefore, reach the mean maximum height attainable in the given soil and locality. This slackening lasts until the coppice grows up again and meets completely over the ground, when the standards begin again to push up in a remarkable manner. It is therefore impossible not to come to the conclusion that 15 years should be the *minimum*, not the *maximum* limit for the coppice rotation, the maximum being certainly not less than 20. This lengthening of the interval between two coppice fellings need not cause any loss of growth, for the thinning can be introduced in a timely manner, say at the age of 15 years; and it will also go a long way to nullify the second objection.

M. Gurnaud's answer to this second objection is more plausible, and even satisfactory. He says: "It is true that the saplings of 15-year old coppice are not worth much, but then you forget that I ask you to reserve 100 of them per acre more than is necessary, and these when cut at the age of 30 years, during the greater part of which interval they have been developing in perfect freedom, will more than compensate for the loss suffered by exploiting the coppice too early." This argument would have still greater force with minima and maxima limits of the rotation at respectively 15 and 20 years.

It will be useful to make a calculation of the relative money worth of an acre of simple coppice worked in the orthodox way on a rotation of 30 years and of another acre worked on the Gurnaud system on a rotation of 15 years. To simplify the comparison I will leave out of consideration the thinning of the Gurnaud system made at the 10-12th year of the coppice.

For the first 15 years the value of the two plots is absolutely identical, the divergence beginning when the Gurnaud area is cut over at the age of 15 years, leaving 120 standards. At 30 years the other acre is cut over with a reserve of 20 standards, which, *for the sake of argument*, we will suppose to be as good as the best 20 of Gurnaud's 120. Let us assume $3\frac{1}{2}$ per cent. as the rate of interest which forest property is required to yield.

Let V_G=money value of the produce of the first Gurnaud felling, also the value of the coppice cut at the second felling (for the 120 saplings reserved at the first felling will be too small and have too restricted crowns to exercise any appreciable effect on the growth of the coppice, and M. Gurnaud has by actual experiment proved that the crowns of the

100 that fall in the second exploitation are a sufficient set off against any loss of growth suffered by the coppice).

Then the total money yield of the Gurnaud acre in 30 years

$= V_G + V_G (1{\cdot}035)^{15}$ + price of 100 strong poles 30 years old . (i)

Now the value of the orthodox acre at the age of 15 years was the same as that of the Gurnaud acre at the same age $= V_G$ + price of 120 poles 15 years old.

Let $r =$ the rate per cent. at which this value has increased up to the 30th year. Hence value of felling at 30 years (20 poles being reserved, which we have already supposed are as good as the best 20 of Gurnaud's 120)

$$= (V_G + \text{price of 100 poles 15 years old}) \left(1 + \frac{r}{100}\right)^{15}.$$

$$= V_G \left(1 + \frac{r}{100}\right)^{15} + (\text{price of 100 poles 15 years old}) \left(1 + \frac{r}{100}\right)^{15}.$$

Now if $r = 3\frac{1}{2}$, as we may take it to be on the assumption already made, the preceding expression becomes

$V_G (1{\cdot}035)^{15}$ + (price of 100 poles 15 years old) $(1{\cdot}035)^{15}$.

The first term here is the same as the second term of expression (i) above giving the value of the produce of the Gurnaud acre in 30 years We have thus left to compare the two expressions, *viz.*, (1) V_G + price of 100 poles 30 years old grown in almost perfect freedom and (2) (price of 100 poles 15 years old constantly grown in dense thicket) $(1{\cdot}035)^{15}$. It is clear that although in both cases the poles are originally the same, in the one case from the age of 15 years they have grown up as standards and therefore more rapidly than those in the other case. Accordingly the Gurnaud figure is something more than V_G better than the figure furnished by the orthodox area.

For the sake of argument I have left out of the calculation the effects of two thinnings and assumed that the 20 30-year old Gurnaud standards grown in almost perfect freedom were no better than the 20 coppice poles of the orthodox area isolated for the first time. Consequently from the financial point of view the superiority of the Gurnaud coppice is undoubted.

CONCLUDING REMARKS.

The application of the Gurnaud system in India will be obvious in forests situated near good markets. At the same time, while it will not be at once fully applicable in others, owing to small wood having no value, a knowledge of its mechanism will enable us to aim as much as possible at securing a favourable relative proportion of the various diameter classes. Speaking of diameter-classes, it is obvious that we may have to adopt different limits for them in India.

III. WORKING PLANS IN FRANCE.

Since our probationers have ceased to go to Nancy for their professional education, the ideas of the French Forest Administration have undergone a radical change. I do not think that my colleagues, who, like myself, have been trained in France, are aware of this. Recently a proposal was made condemning the principle of the Dehra Dun Working Plan as entirely primitive and unsuited to the present advanced condition of forestry in India and recommending the adoption of *Affectations périodiques* and the awkward and now obsolete lines on which French working plans, under the influence of Parade traditions, used to be based. A short account of the present French system, not what may still be taught at Nancy, but what is actually followed through the initiative and under the authority of the *Conseil d'Administration* at Paris, will therefore be read with interest. The artificiality and unpractical character of the old system was apparent to me even during my student days at Nancy, and the special experience gained during ten years' service as Working Plans Officer and as Professor of Forestry at Dehra Dun only strengthened into firm conviction my early doubts. It was therefore with special satisfaction that I learnt on revisiting France after an absence of nearly 22 years that the old system had been given up on the very grounds which seemed to me to require its condemnation.

In describing the new system I cannot do better than give here a translation of a note drawn up by the *Conseil d'Administration** at its sitting of 29th November 1893, recording its orders on a Revised Working Plan for the State Forest of Wisembach, Département des Vosges, submitted to it for approval.

This forest, measuring 1,105 acres (of which 14 unproductive), consists of 63 per cent. silver fir, 30 per cent. beech and 7 per cent. spruce. Under the previous working plan, which has now been completely upset by the present one, it was divided into 4 *affectations* or periodic Blocks, Block I to be regenerated during the First Period of the Rotation, Block II during the Second Period, and so on. Actually, however, during the First Period, while the regeneration of Block I (area 272 acres) was in hand, it was found necessary to complete the regeneration over the greater part of Block IV, and old trees had to be taken out in *Coupes d'extractions* (in German *Auszugshiebe*) from over 156 acres of Block III! During the 20 years from 1863 to 1882 the quantity of material cut out was on an average 82 cubic feet per acre per annum, yielding 26 shillings gross; during the 10 years from 1883 to 1892 the corresponding figures were 91 cubic feet and 29 shillings. The new plan has fixed the yield at 81 cubic feet per acre per annum.

I now give the translation of the Note already referred to.

1. " In the plan submitted for approval it is proposed to exploit during the Second Period 127 acres of crops from 70 to

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*The *Conseil d' Administration* is the highest controlling forest authority under the Minister of Agriculture. It consists of the *Chef du Cabinet* as President, the Director of Forests as Vice-President, and the *Administrateurs* as Members.

90 years old, *viz.*, Compartments F, G, H^2, in order to avoid 'a breaking up of the Periodic Blocks, such as would be totally inadmissible (*un morcellement des affectations tout-à-fait inadmissible*)'. At the same time the extraction of old trees in Block III is to be limited to dead individuals of the upper crop."

2. "These proposals cannot be accepted, and this from an economic point of view. If owing to atmospheric accidents or premature and unexpected decline we have sometimes to include dead trees in our fellings, this disagreeable necessity should never be the consequence of a prejudged fact, still less of a working plan prescription. It is our duty, barring accidents, to furnish to the consumer not only pieces of proper size, but also timber which still possesses all the qualities of the living tree."

3. "Besides this, the premature utilisation of more than 120 acres of woods which have attained neither the age nor the dimensions of exploitability cannot be justified on the ground of the necessity of keeping unimpaired the regular framework of a working plan."

4. "Experience has shown that these frameworks (*cadres*) which the working plans officer confidently imagines he has established permanently for centuries, are being constantly remodelled or completely upset. Such is actually the case with the working plan for the forest of Wisembach. It is also well known that the idea of having the periodic blocks each in one piece, which is made a *sine quâ non* by the *Aménagiste*, is a pure chimera, never having an existence in reality."

5. "With an infinitude of trouble and after numerous trials until he exactly balances the areas, he forms and colours on his map his Periodic Blocks, but no sooner has he done this than, as a rule, he proceeds to spoil the beautiful symmetry by prescribing all kinds of irregular fellings, anticipating here, postponing there, and so on. The result is that there is no longer any correspondence between the Blocks and the Periods, and in place of the fictitious Blocks, each in one piece, we have in reality *working* Blocks made up of compartments scattered all over the working circle and a considerable distance apart from each other."

6. "Coming now from generals to particulars, the proposed working plan before us adopts a fictitious Second Periodic Block composed of Compartments A^2 and K^2 washed yellow on the map, and a real second Periodic Block in three separate pieces, *viz.*, Compartments A^2 and K^2 forming one piece, Compartments A^1, C^1, D^2 and E^2 another, and Compartments H^1 and I^1 a third."

7. "Another defect from which the plan suffers is that as the yield fixed by it has been calculated from the results of the stock survey of only a part of the forest, there is nothing to show that it represents the actual production of the whole forest. Hence the yield of no inconsiderable portion of the fellings proposed to be effected during the Second Period is made a matter of pure speculation and left to the discretion of the officers who have to carry out the plan. These gentlemen would be completely free to work heavily or lightly in the unsurveyed compartments, and thus obtain a large or a small yield just as they pleased, for there would be nothing to bind them beyond the purely cultural prescriptions of the *règlement d'exploitation*, which prescriptions have nothing to do with figures. During the last 10 years of the preceding working plan, although the minimum and maximum prescribed yields of the several years were respectively 61,297 and 70,700 cubic feet, the actual minimum and maximum figures obtained were respectively 66,811 and 122,947 cubic feet.

8. "Hence the necessity of establishing the working of the forest of Wisembach on an entirely new basis."

9. "The method of treatment hitherto applied, *viz.* :—that of natural regeneration under cover by means of uniform successive fellings, which seems* to have yielded satisfactory results, will continue to be applied ; but the determination of the possible yield of the forest based on its division into Periodic Blocks, a procedure which is very wrongly considered by most of our officers as an essential part, even the very essence, of that method of treatment, will be abandoned."

10. "The possible yield will be based on the entire stock standing in the forest, and, consequently, all stems 20 centimetres (8 inches) and upwards in diameter will be included in the enumeration survey."

11. "Such a survey will give an exact idea of the productive resources of the forest, and it will complete in a useful manner the verbal descriptions of the various compartments by furnishing a more accurate presentation of the stock in each than the simple verbal description can give."

12. "The possible yield will be calculated and fixed in accordance with the procedure laid down for forests under jardinage in our Note of 17th July 1883 (see bottom of page 30 lower down). The group of *vieux bois* will be allotted to the first third of the rotation, if the stock

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* It is important to note the word "seems (*paraît*)." For those who can read between the lines there can be no doubt that it has not answered expectations. The susceptibilities of the Parade School, which still dominates in high places the French Forest Administration, have to be dealt with gently.

survey shows both that the relative proportion of the various groups of diameter classes is normal and that taken as a whole the stock in the entire forest is neither excessive nor insufficient. Otherwise the necessary transfers will be made to equalise the distribution of the stock of material."

13. "The total volume of material to be allotted to the first third of the rotation being finally determined, the future increment may be calculated at a moderate rate per cent."

14. "The adoption of this mode of fixing the annual yield necessarily implies the inclusion in it of all the material utilised which is not less than 20 centimetres in diameter; in other words, all intermediate and accidental produce, * as well as the produce of the regeneration fellings and that obtained by the extraction of old and superannuated trees elsewhere than in the regeneration coupes, will combine to form together the prescribed yield."

15. "Thus the prescribed yield will come very near the actual yield, for the difference between them will be represented only by the volume of trees under 20 centimetres in diameter that may be cut."

16. "The yield to be prescribed being now determined, the *règlement d'exploitation* (working scheme) will be prepared. It will not be drawn up for too long a period of time. It will be well not to go beyond 20 years. Above this limit all provisions become more and more uncertain. As the rotation for thinnings at Wisembach is one of 10 years, the working scheme may be prescribed for a period of 20 years."

17. "The compartments will be designated by successive numbers, rising from East to West and from North to South, as shown on the appended map. The boundaries of the compartments will be carefully revised so as to make them follow as much as possible topographical features or export lines, thereby giving them a permanent character. Should a compartment so constituted contain two or more distinctly marked types of crop, sub-compartments may be formed, which will be denoted by small index letters, *e. g.*, 45^a, 45^b."

18. "The compartments (or sub-compartments, if any) will be formed into two groups. In the first group will be placed those compartments the regeneration of which must be carried on or commenced during the ensuing 20 years, in other words, those which will be subjected to regeneration fellings. In the other group will be included those

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* Cleanings and thinnings yield intermediate produce, the utilisation of windfalls and dead and fallen trees accidental produce.

compartments in which only cleanings and thinnings and extractions of superannuated trees will be effected."

19. "The compartments of the first group need not be all connected together in one piece. In choosing them the points to consider are their age, the state of their vegetation, the results of previous operations that may have been made in them, the facility or difficulty of clearing produce out of them without hurting other compartments, the class of produce they contain, and the special dangers from atmospheric phenomena to which they may be liable."

20. "An examination of the results of stock-taking will be useful in determining the number of compartments to put into the first group. Their aggregate area should be large enough to permit of coupes being located in them without requiring any sacrifice of cultural requirements. The fact must not be lost sight of that the group in question is not an *affectation* to be regenerated in the space of 20 years, but, as has been clearly said above, is the collection of compartments in which regeneration is to be carried on or commenced during this period"

21. "The compartments of the first group will be indicated on the map with a uniform blue wash; those of the other group will not be coloured at all."

22. "The working scheme will suggest the probable order in which the compartments of the second group will require to be regenerated. These compartments will also be allotted severally to the ten years of each of the two ten-year rotations fixed for the execution of thinnings and for the extraction of superannuated trees."

23. "The regeneration fellings (in compartments of Group I) will be based on volume; the felling in the other compartments on area."

24. "If, irrespective of the regeneration fellings, in any of the compartments of the first group the necessity of thinnings in definite years can be foreseen, these thinnings will be duly prescribed and will either constitute a separate series of itself or form part and parcel of the general series for the whole forest."

25. "In applying the working scheme, the coupes based on area will be marked first. In marking them it should not be forgotten that the fellings to be made in them are only thinnings. Every temptation to effect irregular and untimely regeneration should be resisted; but if the coupes contain superannuated trees, there should be no hesitation in marking them and thus utilising them before they are quite dead. The officers who will mark these coupes will bear in mind that what they have to do is to raise

flourishing crops and to place them in the most favourable conditions for development. At the same time they will refrain from attempting to form any very regular crops by sacrificing this or that age-class."

26. "The coupes based on area being marked, the total volume of material in trees 20 centimetres and more in diameter so marked will be made out and deducted from the figure of the prescribed yield. The balance will be the quantity of wood to obtain from the regeneration fellings."

27. "These fellings will be located and made in accordance with the usual rules. Nevertheless all sacrifice of exploitability will be carefully avoided, and there should be no hesitation in preserving and considering as part of the new generation every thriving tree that is still too small to be profitably exploited."

28. "It will be noticed that except what concerns the method of determining the yield to be prescribed by the working plan and that of realising it when applying the working plan, all that has been here ordered is in entire conformity with the procedure most generally followed in the treatment of the conifer high forests of Eastern France."

29. "On the expiry of the present period of 20 years, the yield of the forest will be worked out over again after a fresh complete stock-taking, a new distribution of the compartments into two groups will be made and a new working scheme drawn up. A comparison of the results of the two stock-takings will ensure everything being done with greater precision and certainty than at present."

Paragraph 12 of the note just translated requires the possible yield to be calculated in accordance with the procedure laid down in a note of 17th July 1883. It would be too long and superfluous to give here a translation of that note. I will therefore explain the procedure in a few words and make it clear by a concrete example given me by the able officer in charge of working-plans in the Vosges Conservatorship, M. Basaille.*

The procedure is based on the assumption that in a normal forest, consisting of one-aged crops from 1 to n years old (n = rotation), the volume of the crops from 2/3 *n* to *n* years old is to the volume of the crops from 1/3 *n* to 2/3 *n* years old as 5 to 3 (this assumption is not quite true, for the proportion is sometimes as low as 4 : 3). These two groups of crops are termed respectively the old and middle-aged classes, that from 1 to 1/3 *n* years old being designated the young age-class.

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* After the present Report was ready for submission, I received copy of a later Note of the Conseil d'Administration than that of 29th November 1898, translated above. This later Note, entitled "*Traitement des futaies pleines*," is a general standing order prescribing the treatment for *all* high forests of silver fir, spruce and beech, pure or mixed, which are "not to be put under jardinage." It merely brings together into a single short note all the principles laid down in those of 29th November 1898 and 17th July 1883, and therefore emphasises more clearly the great revolution that has taken place in the ideas of the body of officers who control the French Forest Department from Paris. It still reflects the fear of the writers of exposing themselves to a charge of heresy, for while condemning unreservedly the old system of "*aménagement en futaie pleine par la methode du réensemencement naturel et des éclaircies*," and prescribing what is nothing more than a sensible jardinage, they play upon the word "pleine" to show that they are aiming at something quite distinct from jardinage.

One more assumption is made, and that is, that if *d* = diameter attained at the age of *n* years, the diameter at 1/3 *n* years will be $\frac{d}{3}$, and at $\frac{2}{3}$ *n* years $\frac{2d}{3}$. This assumption also is not absolutely true, but after all, to arrive at some simple and practical rule it is necessary to adopt approximate figures.

These two assumptions having been made, all the trees $\frac{d}{3}$ and upwards in diameter are measured and cubed and arranged in two groups, *vis.*, old trees and middle aged trees. Let the total volumes of these two classes be denoted by V_o and V_m respectively, $\frac{V_o}{V_m}$ may be equal to, more than, or less than $\frac{5}{3}$. The case of equality (the normal forest) would be so exceptional that it need not be considered.

First, let us suppose that V_o is in excess $(=e)$; then $\frac{V_{o-e}}{V_{m+e}} = \frac{5}{3}$ and $(V_o - e)$ *plus* its current increment is the volume of old trees to exploit during $\frac{1}{3}$ *n* years. No attempt is made to ascertain by observation of the crop what the increment will be; it is calculated by assuming a low rate per cent. of increase and computed for half the period of $\frac{1}{3}$ *n* years. The quantity *e*, thrown in with the middle-aged trees, is taken from the youngest age-class in the group of old trees. Now the number of trees comprised in $V_m + e$ is bound to be in excess of the number required to get ultimately into the group of old trees at the end of the first period of $\frac{1}{3}$'*n* years; consequently some must be cut out during this period. How many these should be, or rather what volume they should represent, is determined by assuming that the trees of the middle-aged group put on a certain rate of increment (much more of course than that assumed for the old class). This increment is obviously worked out for 1/3 *n* years. Suppose it $= i$. Then, if no trees at all of the middle-aged group were cut, its volume at the end of the 1st period of 1/3 *n* years would be $= V_m + e + i$. But, assuming always that the forest is fully stocked, this amount will invariably exceed $V_o - e$, which is after all the volume of old trees that will again be wanted. Hence the difference $= (V_m + e + i) - (V_o - e)$ will be cut. Therefore the total amount to be removed in all the fellings is equal to the quantity to fall from both the old and middle-aged groups $= (V_o - e) + [(V_m + e + i) - (V_o - e)]$ + increment of old group in $\frac{1}{3}$ *n* years $= V_m + e + i +$ increment of old group in $\frac{n}{6}$ years. In both cases the increment is calculated by the rules of simple interest, so that the last expression may be written out in full thus, r_o and r_m representing respectively the annual increment of unity of the two age-groups.

$$\tfrac{1}{6}(V_o - e)\,r_o n + V_m + e + \tfrac{1}{3}(V_m + e)\,r_m n$$

$$= \tfrac{1}{6}(V_o - e)\,r_o n + (V_m + e)\left(1 + \frac{r_m n}{3}\right).$$

And similarly, if the middle-aged group is in excess, the quantity to be cut out during the first period of $\frac{1}{3}$ n years

$$= \frac{1}{6}(V_o + e)\, r_o\, n + (V_m - e)\left(1 + \frac{r_m\, n}{3}\right).$$

Combining both formulæ, we have for the prescribed annual yield $\frac{r_o}{2}V_o \mp e) + (V_m \pm e)\left(\frac{3}{n} + r_m\right)$, according as the volume of the old age group is in excess or defect as regards the ratio of 5 : 3.

Figures taken from the working plan for the communal forest of St. Michel-sur-Meurthe, area 791 acres, will illustrate the application of the last formula. The enumeration survey showed that the forest contained.

$V_o = 2,216,551$ cubic feet in the old age-group, and

$V_m = 848,294$ „ „ „ middle-aged group.

The excess of old wood was thus 301,023 cubic feet (= e). The rotation (n) was chosen at 144 years, and the rates per cent. of growth for the old and middle-aged groups were assumed to be respectively 1 and 2·5, so that $r_o = 0{\cdot}01$ and $r_m = 0{\cdot}025$, hence prescribed annual yield

$$= \frac{001}{2}(2,216,551 - 301,023) + (848,294 + 301,023)\left(\frac{3}{144} + 00{\cdot}25\right)$$

$$= \frac{1,915,528}{200} + (1,149,317)\frac{66}{1,440}$$

$$= 9,578 + 52,677 = 62,255 \text{ cubic feet for the whole forest}$$

$$= 79 \text{ c. ft. per acre per annum.}$$

An important point to notice in this working plan is the limits of diameter chosen for the two diameter-groups of old and middle-aged trees. The exploitable diameter being 55 centimetres, the corresponding limits ought to have been 55, 36⅔ and 18⅓ centimetres; but the figures actually taken were 55, 35 and 20, which, except the first, are M. Gurnaud's limits, while the first is only such a slight modification that the entire classification may be considered the Gurnaud one.

One cannot also help being struck with the ratio of 5 : 3 between the two upper diameter-groups laid down for all working plans for high forests whatever the method of treatment. This, it will be remembered, is also the Gurnaud ratio.

Again, the calculation of the total increment by assumnig, without any reference whatsoever to special observations made in the crop, a moderate figure for the rate per cent. of increase is also an essential peculiarity of the Gurnaud system. Still further, the strict debiting of all windfalls and other accidental utilisations against the total of the prescribed yield and the inclusion within the latter also of the produce of thinnings of all trees 20 centimetres and upwards in diameter are also essential features of the Gurnaud system.

In other words, we see the unacknowledged influence of M. Gurnaud everywhere; and what is still more important, the silent struggle, the issue of which is never doubtful, between the old order and the new. In the opening paragraph of the second Note remarks regarding jardinage are made in an apologetic tone and the *méthode de ré-ensemencement naturel et des éclaircies* is spoken of as the method to be applied everywhere save under very exceptional circumstances, and then the rest of the Note is devoted to a discussion of *un jardinage rationel* and a method of fixing accurately a regular and sustained yield in such jardinage is devised, which is at once applied without any modification to the determination of the yield of forests to be treated by the "classic" method. In the Note of 1883 it is said that "if it were possible to estimate the aggregate areas occupied severally by the three diameter-groups (old,* middle-aged and young) and these areas were found to be equal, the high forest under jardinage would, from the point of view of the possibility, be entirely assimilable with a regular forest." Ten years later this view is so completely changed and so totally reversed that the procedure for jardinage is applied without any modification to "regular" high forest, that is to say, it is the "regular" high forest that is "entirely assimilated" with high forest under jardinage and the grouping of the different age-classes on separate areas and the aggregate areas they severally occupy are never once admitted as an influencing factor in the determination of the annual yield! And not only this, but in the working plan for the "regular" high forest of St. Michel-sur-Meurthe, even the distribution of the diameter groups over equal areas (the very essence of the *méthode de ré-ensemencement naturel et des eclaircies* is completely abandoned. The range of the middle-aged group, which is assumed to increase in volume at the rate of 2 per cent. per annum, is fixed over only 15 centimetres (between 20 and 35), whereas that for the old group, the volume increment of which is assumed to be made only at the rate of one per cent. per annum, is fixed over 20 centimetres. Now reference to Schuberg's Yield Tables for silver fir in the Black Forest growing under good conditions of soil and locality shows that diameters of 20, 30 and 35 centimetres are reached respectively at the ages of 46, 79, and 146 years, so that whereas the middle-aged group would comprise only 33 crops, the old group would consist of 67 crops or more than twice the number. It would have been fairer to have taken Schuberg's figures for average conditions of soil and locality, but unfortunately they do not go beyond 150 years, at which age the average diameter is only 44 centimetres. But if we may carry on the table beyond 150 years by the rule of proportions, the number of *old* crops would be very nearly four times greater than that of *middle-aged* ones! All this is a silent, but eloquent, *volte-face* towards jardinage, patent to every outsider, but not even suspected by a great many of the persons concerned.

IV. INSPECTION OF BAGNÈRES-DE-LUCHON, AND THE COMMUNAL FOREST OF MONTAUBAN.

This is one of the six divisions (5 Inspections and 1 Chefferie) of the 18th or Toulouse Conservatorship, which controls 348,940 acres of forests, 243,574 belonging to the State, and 105,366 to Communes and other Corporations. The Divisional Officer of Bagnères-de-Luchon administers 12,696 acres of State and 30,191 acres of Communal forests = a total of 42,887 acres. This is much less than one-sixth of the area of the circle, but, on the other hand, the forests are scattered and the ground very rugged and mountainous.

The *inspection* is divided into three *cantonnements* or ranges containing respectively 19,217, 10,695, and 12,975 acres, while the total number of beats is twenty-eight, the largest comprising 2,729, the smallest only 711 acres, the average being 1,532. The great difference in the area of the beats is due to the large number of communal forests, which are naturally scattered and often of limited extent.

The establishment consists of the *Inspecteur* or Divisional Officer three *Inspecteurs Adjoints* and *Gardes Généraux* or Range officers, six *Brigadiers* or Head Guards, and twenty-eight *Gardes* or Beat Guards. As regards office staff, there is only a single clerk who is attached to the divisional office. Clerical work is, however, not heavy in Divisional offices in France, as there are no departmental operations and accounts consequently give little trouble. I may also mention here that there is never any provision for an office establishment for the Ranges. If the work is relatively heavy, a Brigadier or Guard resident at the headquarters of the range helps in the office.

The expenditure of the Division is roughly as follows :—

	Francs	£
Salaries and allowances of superior officers . .	15,000=	600
,, ,, subordinates . .	30,000=	1,200
Share of Conservator's office expenses . . .	3,000=	120
Communications, buildings, etc.	2,500=	100
	50,500=	2,020

equivalent to 11·3*d.* per acre per annum,

The Revenue is as follows (figures of 1894) :—

	Francs.	£	
From State Forests	15,000=	600=	11·3*d.* per acre.
Communal Forests— Produce sold 31,500 Delivered in kind 10,400 . .	41,900=	1,676=	13·4*d.* ,,
	56,900=	2,276=	12·7*d.* ,,

Thus the net revenue is only 1·4d. per acre per annum.

The prevailing species are beech in the valleys and on the lower slopes up to 3,000—3,500 feet above the sea according to the aspect, mixed beech and silver on the middle slopes, and almost pure silver fir from 3,500—4,000 (according to aspect) upwards. In giving these figures I have, for the sake of simplicity, stated them in round numbers.

The vertical distribution of these two species is, according to the Divisional Officer, M. Bartet, as follows :—

Beech	On Northern aspects up to	3,900 feet.
	" Southern " "	4,600 "
	" Western " "	4,100 "
	" Eastern " "	4,900 "

Silver Fir	On Northern aspects from	2,950	to 5,900 feet.
	" Southern " "	4,400	" 5,500 "
	" Western " "	3,900	" 5,600 "
	" Eastern " "	3,600	" 5,500 "

The beech forests are worked on the peculiar coppice system known as *furetage*, in which, instead of a complete sweep being made of the whole coupe, only stems above a certain minimum diameter are cut. It is evident that with such a method of exploitation the production of "trees" is impossible, the only thing sought being small poles. The two advantages it offers over the ordinary coppice method are that the soil is always kept covered and frost cannot do much, if any, harm, and that wood of unsaleable size is not cut.

From the point at which silver fir enters into mixture upwards the forests are treated by the selection system or jardinage. Until recently this jardinage was of the most primitive character, the result being that they have still the appearance of quasi-virgin forests, with the usually preponderating element of crooked, old, sickly, canker-stricken or half-rotten trees. Hence the extremely low prices commanded by the fir timber—only 5 francs per cubic metre or 1·35*d*. per cubic foot standing. The antiquated and erroneous conception of jardinage (unfortunately perpetuated by authoritative teaching), according to which a dead or dying tree here and there is to be removed, a few sound trees being thrown in under the *force majeure* of the insufficiency of the others to make up the annual yield, is responsible for the wretchedly bad condition of these forests. There is only way to remedy this state of things, and that is to boldly raise the figure of the annual yield and thus secure the rapid removal of the old unsound trees and all the younger ones attached by the Æcidium. No danger need be apprehended from thus raising the quota of the annual fellings. My examination of these forests and of those of the silver forests in Savoy, in the Vosges and in the Black Forest makes me feel certain that the forests here are greatly underworked, and my opinion is confirmed by the recent discovery of the French Working Plans Branch that in *all* the working plans prepared up to so late as six years ago for forests under jardinage the annual yield had been greatly under-estimated. In a forest under jardinage you may cut as little as you like, and indeed cut out nothing at all, without hurting the forest looked at as a mere collection of trees completely covering the ground, and actually the French Forest Department, carried away by the uncompromising zeal for *épargne*, which still animates it, and by the spirit of *prudence* (to be translated in this case by the word "over-caution") purposely calculated the annual yield on the basis of the present stock, leaving the current annual increment to go on accumulating. But the necessary result of such a policy in forests worked in accordance with the mistaken view that jardinage is synonymous with the utilization of superannuated, unsound and dying trees is the continuously increasing accumulation of such trees, and the forests of the Luchon Inspection are a standing example of what forests must come to when worked in this spirit of fearful over-caution.

Owing to the very large proportion of cankerous trees, no timber-dealer cares, at the auctions of standing material, to bid anything much higher than the price of the worst trees. Thus the average price obtained for silver-fir timber standing is only 5 francs per cubic metre, equal to 1·35*d*. per cubic foot. It is certain that if the timber were sold after being felled and assorted according to quality, a very much better average price would be realised.

In the Pyrenees roads are also a great desideratum. The only cartroads are those which have been constructed for general traffic and it is by mere accident that any such road traverses one of the forests or even runs close to it. For the Luchon Inspection the newly-made railway from Montrejeau, connecting this popular bathing resort with the main line, has been a godsend, but until roads tap every part of the forests, these will derive but little advantage from the presence of the railway. In the absence of roads, the wood is brought down dragging paths which ravine the mountain sides and become running torrents after heavy rain and on the melting of the snow. Also, the timber has to be cut up into logs of only 8 feet length, another reason for low prices. It will interest Indian foresters to know that only horned cattle are used in the dragging operations, as horses have been found to be too lively and dangerous for such work.

The character of the forests and of forest conservancy in the Pyrenees will be more clearly gathered if I describe below one of the forests I visited. For this purpose I have selected the communal forest of Montauban situated on a mountain overhanging Luchon on the south and hence having the railway less than two miles from its boundary with a cartroad connecting the line with the village, which lies at the foot of the mountain.

SPECIAL DESCRIPTION OF THE COMMUNAL FOREST OF MONTAUBAN.

This forest, having an area of 631 acres, extends vertically between 3,110 and 5,750 feet above the sea, its lowest point being 1,047 feet above Luchon which is situated at the bottom of the valley. It begins a few hundred feet above the foot of the mountain and extends right up to the top.

For climatic purposes the area may be divided into two zones, the lower below, the higher above 5,000 feet. The first falls of snow occur in the lower zone at the commencement of November, in the upper at least a week earlier, and the last falls in this latter zone may take place as late as the end of April and the beginning of May. But the first and last falls melt in at the most a few days, and the ground remains constantly covered with snow only from the middle of December to the second half of February in the lower zone, and from the middle of November to the first fortnight of April in the upper zone. It will thus be seen that the climate is fairly severe during winter and spring. And at no time of the year are the shade temperatures ever high.

The soil is a free loam of variable depth (16 to 40 inches), more or less moist according to the elevation, and of more than medium fertility for the silver fir. It rests on schists and shales of the Cambrian period.

In a general manner it may be said that nine-tenths of the stock consist of silver fir and one-tenth of beech, scattered birch being found nearly everywhere. Pure fir occupies principally the north-westerly aspects betweeen 3,300 and 3,600 feet and the crests of the spurs and ridges.

The existence of two zones of climate makes a marked difference in the regeneration of the silver fir. In the lower zone the trees seed more or less abundantly nearly every year, and of the seedlings that result many survive, so that regeneration is always going on and never presents any difficulty. In the upper zone, on the other hand, not only are the seed years less frequent, but the seeds ripen with difficulty and germinate late (June-July), so that the tender plants often succumb before the dry winds that blow from the south in summer, the result being that the ground is successfully sown only once every 10, 15 and even 20 years, and the crops have a regular appearance owing to a greater or less uniformity of ages.*

The entire area is, it is scarcely necessary to say, under jardinage, the rotation of the fellings being 17 years. The working plan, which has been drawn up for a period of 17 years and expires in 1900, fixes the annual yield at 27,926 cubic feet, equal to 44 cubic feet per acre. This is a very low figure and will certainly be very much raised in the year 1900, when the working plan is revised. In the lower climatic zone the abundant regeneration justifies a free style of cutting not only in the top story of the forest, but also in the middle one, so as to get rid of cankerous trees as soon as possible. The present divisional officer tries to carry out this double operation (*viz.*, extraction of old trees from the top story and thinnings in the middle story, all bearing as much as possible on canker-stricken trees) to the full extent that the limited quota of the fellings allows him.

The produce of the fellings consists almost entirely of silver fir, as the beech is still very young and small, a war to the knife having been made against it until a few years ago. Of the annual yield 80 per cent., roughly speaking, is timber, which sells at about 1*d.* per cubic foot, a most miserable price considering the accessibility of the forest.

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* Instances of this peculiarity are common enough in the conifer forests of the higher Himalayas.

No better proof than this can be found for the condemnation of the system of jardinage that prevailed until only a few years ago, and it is after such wretched botching like this that jardinage as a general method of treatment has been judged and condemned! Fortunately the tide has now turned and the recklessness with which a persistent attempt was made to force all forests, whatever the prevailing species, climate, soil and topography, into the rigid framework of the so-called "classic system" of "*Ré-ensemencement naturel avec éclaircies* (as if jardinage excludes either natural sowing or thinnings!) is now freely admitted and with unmixed regret for many and many a forest that would have been all the better for a continuance of jardinage—not the antiquated, absurd jardinage of our old text-books, which allowed the trees to enter upon their decline and even become rotten and die, but jardinage based on common sense and freed from all preconceived ideas.

REMARKS.

It was specially interesting for me to visit a region in which so many of the conditions in which the French Forest Department has to work are similar to those which prevail in most of our forests in India—absence of roads, low prices, a superabundance of old, unsound trees. But whereas we in India labour under the immense disadvantage of distant and often even remote markets, the Pyrenean forests have excellent markets close by which are ready to take every cubic foot of wood they produce. Moreover, ours is a new department, miserably undermanned, and still an exotic among a people, who, in their ignorance, believe that forests are inexhaustible and require no protection from abusive enjoyment. The result of my visit has been to prove to me that our Indian Forest Department has every reason to be satisfied with the progress it has made, and that in a near future it will be able to stand a direct comparison, not always unfavourable to itself, with the Forest Departments of the European Continent.

V. COMMUNAL FOREST OF APREMONT.

Apremont is one of the villages of the department of Savoie, lying about 7 miles to the north-west of Chambéry. Both Savoie and Haute-Savoie, being mountainous and rugged, constitute a pre-eminently forest region, the percentage of forests to the entire area being respectively 41 and 43. Having, however, come into the possession of France only so recently as 1860, the area of State forests is very limited, as will be observed from the following figures :—

	State.	Communal.	Total.
Savoie	3,563 acres	187,959 acres	191,522 acres.
Haute-Savoie	745 „	108,813 „	109,558 „
TOTAL	4,308 acres	296,772 acres	301,080 acres.

Besides the above, a very large area of wooded land is in the possession of private individuals.

The forests belonging to the commune of Apremont occupy the higher slopes of the village area right up to the top of the ridge and comprise 705½ acres composed as follows :—

Unproductive	14½ acres	705¼ acres.
Productive blanks	12¼ „	
Wooded, but unworkable	77¾ „	
„ „ and workable ...	500¾ „	

They extend from 1,253 to 5,038 feet above the sea, the mean elevation being about 3,000 feet. The climate is thus from temperate to almost alpine and late frosts are not unfrequent.

The soil is of medium quality, resting on schists and limestone. Moisture is never wanting and the ground under exposure quickly covers itself with an exuberant herbaceous vegetation.

The stock consists of 79 per cent. silver fir and 20 per cent. beech, the rest being constituted by maples, oaks, chestnuts and spruce, scattered or in groups.

Whatever the system of management, one-third of the area, taken in rotation, must always remain open for grazing, which is, however, not heavy, the number of head pastured averaging only 35.

The area is divided into four working circles, one, the highest, under high forest, the other three under coppice, as follows :—

First working circle, high forest,	182	acres divided into	14 compartments.
Second working circle, coppice,	109¼	„ „ „	30 equal coupes.
Third „ „ „	168¼	„ „ „	30 „ „
Fourth „ „ „	168¼	„ „ „	30 „ „

The remaining 77¾ acres situated at the highest point and on precipitous slopes, and classed above as unworkable, is kept intact for purposes of protection.

The present arrangement dates from 1892, when the original working plan was radically revised. Under that working plan the area under forest management was larger by 66¾ acres and there was no portion left untouched for protective purposes, while the constitution of the four working circles was as under :—

Working circle of high forest	129¾ acres.
First working circle of coppice	210¼ „
Second „ „ „	220¼ „
Third „ „ „	212 „
Total area .	772¼ acres.

The high forest working circle is very properly under jardinage, the quantity that can be cut annually being fixed at 7,388 cubic feet= 44 cubic feet per acre per annum. Actually however this quantity is not cut every year. The stock in the high forest working circle is treated as the *quart en réserve* of the French forest law, that is to say, it is set aside to be drawn on only on occasions of special need, as when an extraordinary financial emergency has to be met, and so on. The maximum quantity that can be cut out on any occasion is hence the accumulated annual yield unrealised up to date. Under the original working plan, as was the case in the old French working plans, the annual yield was fixed much below the annual production, with the result that the stock contains an excessive proportion of old trees (*viz.*, those 16 inches and upwards in diameter). It was, however, not deemed advisable to realise the entire accumulation within the next 20 years for which the present revised plan has been drawn up, and a part has been held back for the next ensuing period. Even then the annual quota of 44 cubic feet for the current period is fairly high for a forest situated between 4,000 and 5,000 feet and growing on steep slopes and on soil of medium quality and worked in accordance with the far from intensive jardinage of the French school.

The produce of the coppice working circles is exploited annually and is delivered direct in kind to the commune. Leaving out the value of this produce, the forest gives an annual gross revenue of £99 and a net one of £78 or about 8*s*. per acre. Under the original working plan the corresponding figures were £56, £37, and 5*s*. respectively.

VI. SPECIAL INVESTIGATION OF FACTS AND PHENOMENA CONNECTED WITH FORESTRY.

To Germany belongs the credit of being the first to start an organised enquiry of this nature.

Although Karl Heyer had since 1845 spared no effort to establish some general agency for carrying on such enquiry, up to 1868 only isolated efforts were made by a few enthusiastic workers, such as the two Heyers, Faustmann, Ebermayer, etc.

At last in 1868, at the Conference of Forestry and Agriculture held at Vienna, a committee of five gentlemen were appointed to devise a scheme for scientifically investigating all facts and phenomena connected with the distribution, growth, cultivation and management of forests. It was, however, not until 1872, after the disturbing influences of the war of 1870-71 had ceased, that the work of pursuing such an investigation was organised and set on foot. The States of Prussia, Bavaria, Saxony, Württemberg, Baden, Hesse, Brunswick and Alsace-Lorraine and the Thuringian principalities established their respective bureaux for Forest Research (Forstliche Versuchsanstalten) to work in co-operation with each other and as much as possible on the same lines, such co-operation and identity of objects pursued being secured by means of annual meetings, at which reports of work done are read and discussed and plans for future work laid down. The various Research Bureaux constitute together the Verein Deutscher Forstlicher Versuchsanstalten (Association of German Forest Research Bureaux), the business of which is directed by the Prussian Bureau.

In Prussia the researches are carried on by the staff of the Forest Academy at Eberswalde, separately in the five several departments of Forestry proper, Chemistry of soils, Meteorology, Vegetable Physiology and Zoology. The work in the department of Forestry proper is entrusted to one of the Professors of Forestry specially selected for the purpose, in the other four departments the professors who teach the respective subjects are *ex officio* in charge of the investigations. The general control of the whole business is in the hands of the Director of the Academy.

In Bavaria there was at first no special agency, local forest officers being required to carry on the enquiries within their own charges. The results obviously proved unsatisfactory and since 1875 the professors in the Forestry Faculty of the University of Munich compose the Research Bureau. Here however there are only three departments of research, *viz.*, (1) that of Forestry proper, (2) that of Soil Chemistry and Forest Meteorology, and (3) that of combined Botany and Zoology. The three sections are entirely independent of each other and have no common directing head. Although the theoretical division of subjects is clear, yet we have the anomaly of the Botanico-Zoological section dealing with purely forestry subjects.

In the kingdom of Saxony each professor at the Tharand Forest Academy is, under the Presidency of the Director of the Academy, entrusted with the enquiries relating to the special subject which he teaches, but the work in the special forestry branch is especially the business of the Professor of Forest Mathematics,* and the Head of the Working Plans Branch at Dresden is *ex officio* a member of the Research Bureau.

In Württemberg the Bureau is attached to the University of Tübingen and is under the direction of one of the Professors of Forestry. Forming an adjunct of the Bureau is a Laboratory for the investigation of the technical properties of woods, which, during his lifetime, was under the independent control of the late well-known Dr. Nördlinger.

In Baden the Bureau exists since 1870 and is composed of a committee selected, partly from the Council of Forest Administration, partly from the teaching body of the Forest School at Karlsruhe.

In Hesse a Research Bureau dates only since 1882 and is in direct connection with the forestry faculty of the University of Giessen, the two Professors of Forestry being chiefs in their respective branches, but under the general direction of one of themselves, who is also head of the Faculty.

In Alsace-Lorraine the enquiry was directed up to 1882 by the Prussian Bureau, but since then the State has its own Bureau at Strassburg under the direction of the officer in charge of the forestry branch of the State.

There is no interest in describing the organisation of the Research Bureau under such petty Governments as those of Brunswick and the Thuringian States.

Switzerland possesses a Research Bureau since 1888 under the able direction of the indefatigable Dr. Bühler and controlled by a committee of seven members appointed by the Federal Council. This is the best organised of all the Research Bureaux, including those of France and Austria. The records, laboratory and office occupy more than half an entire floor of the great Physical Science Block belonging to the University of Zurich. Dr. Bühler has a staff of 2 assistants who give all their time to his researches and a staff of female clerks and computers. More than 450 experimental plots, scattered over the whole of Switzerland and representing every class of forest and system of treatment and every condition and factor of growth to be found in that country are under observation. Besides them there is the remarkable garden on the Adlisberg, where within the space of less than 2 acres experiments are being conducted with every native and some foreign species of trees to determine exactly their requirements as to composition and depth of soil, aspect, moisture, light, shelter, closeness of growth, season of sowing, season and age of planting, etc. In a large number of the experimental plots daily meteorological observations are taken in order to fix exactly the relation between climatic phenomena and forest growth. The work is enormously heavy, but it is so skilfully organised that it is done in a most thorough manner by the two assistants and by Dr. Bühler, who has also to lecture at the University. The records are a marvel of neatness, precision, completeness and orderliness. The results of any one of the tens of thousands of measurements which have been made can be looked up in a minute. Dr. Bühler has very kindly given me a blank specimen of the principal forms he uses. These are attached. All the results of the experiments are summarised from time to time and published in annual volumes.

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* This is due to the famous Pressler having occupied the chair of Forest Mathematics.

The work of forest research has been organised also in Austria on a large scale and is directed from Mariabrunn.

France started late, in 1882, after sending Messrs. Reuss and Bartet to certain parts of Germany to study the system established there. The French Bureau concerns itself only with forestry proper. A junior officer of rank not higher than Inspecteur-adjoint carries on the work under the orders of the Director of the Forest School. He has no other duties, but has no one to help him and cannot therefore accomplish much. The points sought are specially limited to (1) comparative results of thinnings in which only suppressed stems are removed (*éclaircie par le bas*) and of those which take out trees exclusively from the upper stage of the leaf-canopy (*éclaircie par le haut*); (2) determination of the increment during the course of natural regeneration by seed effected by means of successive fellings made uniformly over the crop operated upon; (3) determination of the *mean* annual increment, the *current* annual increment, the *mean* rate per cent. of gross money returns, and the *current* rate per cent. of gross money returns of a regular silver fir crop in the Vosges and of regular crops of broad leaved species near Nancy; and (4) testing of the Gurnaud system of treating high forest.

The comparison of the two different modes of thinning practised in France is not being carried out fairly. The *éclaircie par le haut*, the system taught by the Nancy school, is of course being properly carried out; but the way in which the other system is applied in the experiment must be objected to, for the thinning is confined exclusively to the suppressed part of the crop even where oaks have been outgrown and overtopped by beech. However strictly the term *par le bas* may be understood, it never excludes the freeing of the crowns of a sufficient number of promising oaks in a mixed crop of oak and beech. Beech always grows much faster than oak in early life and must be kept back in the immediate neighbourhood of oaks destined to form the main part of the further exploitable crop. This does not however mean that the idea of thinning *par le bas* at other points and when the oak is old enough to hold its own in the race upwards cannot be carried out as strictly as possible. What has actually been done in the experimental plots has had the effect of unfairly keeping back the oak in those thinned *par le bas*. Nearly all German, Austrian and Swiss foresters thin *par le bas*, but in mixed crops, while cutting out suppressed stems, they do not forget to free the crowns of individuals of the more valuable species which are being outstripped or overtopped by individuals of inferior kinds. To make matters still more unfair for the *éclaircie par le bas*, the plot which has been assigned to it contained, at the beginning of the experiment, 64 per cent. beech and only 14 per cent. oak, while the one assigned to the *éclaircie par le haut* contained only 7 per cent. beech and 88 per cent. oak. No further comment is necessary. As regards rate of increase, whereas in 1882, when the experiment was commenced, the mean annual increment was only 1 cubic foot per acre better in the plot assigned for thinning *par le bas*, in 1886, four years after the first thinning, the advantage had risen to 3 cubic feet, and in 1893, seven years after the second thinning, it had increased to 7 cubic feet. The more rapid growth in this plot may be due partly or even wholly to the preponderance of beech, but obviously no certain conclusions can be drawn. It is thus apparent, without considering further reasons, of which there are many, that this experiment can lead to nothing and it is waste of time and energy to continue it longer.

The experiments to determine the second point, *viz.*, the rate of growth during the successive regeneration fellings made to secure reproduction under cover, are unimpeachable. A very close seed-felling (*Coupe d'ensemencement très-sombre*) in oak and beech forest was followed during the immediately succeeding 4 years by a mean current annual increment of 69 cubic feet per acre per annum, at the rate of 1·54 per cent. on the initial stock. A dark seed-coupe is however really only a fairly strong thinning and proof is hardly required to show that it does not entail loss of growth. It is the results of the after-fellings which supply the points for crucial test. In another area two such fellings have been made, the first ten years after the first seed-coupe and five years after the second seed-coupe (both seed-coupes had been *très-sombre*), and the second after-felling 4 seasons after the first. Unfortunately the stock standing just after the first and second seed fellings and the quantity of material removed in the latter are not known; so that the results as regards rate of growth can be given only from the date of the first after-felling. These were as under:—

	Mean annual current increment per acre. Cubic feet.	Rate per cent. on initial growing stock.
During the four years between the two fellings	106·9	3·41
„ 6 years succeeding the second felling	87·5	3·30
„ 10 „ „ first „	89·3	2·85

The fall in the rate of growth is very marked after the second after-felling, nevertheless the increment is still pretty high and it must not be forgotten that 20 years have elapsed since the regeneration was begun. A very noteworthy fact is the fillip given to growth by the first after-felling, and it is certain that up to the final felling the rate of growth will not sink below 2 per cent., for the increment made by the new regeneration will already begin to be appreciable.

The third class of experiments must be prosecuted for a great many more years before conclusions of any value can be deduced from them, for the idea is to have under observation one and the same crop to obtain the results for different ages. This procedure is a mistake, since even if the experiments are continued for a century, it will not be possible to generalise from the results yielded by one or two small plots for each class of forest. This is a fault from which no part of the work of the Nancy Bureau is free and which is inevitable so long as the exiguous basis on which the Bureau has been established is maintained. Real progress in forestry can be made only on the condition that the laws of forest development are accurately known and understood, and without such knowledge much time is wasted and progress arrested by futile discussions based not on facts, but on *idées fixes* and *partis pris*. Mere assertion and unfair belittling of opponents takes the place of arguments, and the most convincing argument is the official power and authority to enforce one's opinion. Already, in spite of the very limited scope of the operations of the Nancy Bureau, many time-honoured beliefs which had been accepted as truisms have had to be given up.

The fourth point under observation, *viz.*, the value of the Gurnaud system, has been treated by me in a separate report exclusively devoted to that head. (See pages 9—24.)

Besides the four main points already enumerated and just considered, observations have been made to establish the following points:—

(1) The mode of growth of oak in coppice with standards.

(2) The influence of the cover of the standards in coppice with standards.

(3) The influence of the season of vegetation on the production and development of stool-shoots.

(4) The effect of cutting back broad-leaved seedlings in a nursery.

(5) Advisability or otherwise of using chemical manures in forest nurseries.

(6) The effect of covering sown seeds with saw-dust or peat as compared with the composts usually employed.

(7) Autumn *versus* spring sowing.

(8) Cause and cure of red rust on needles of pine seedlings (German Schütte), which causes them to be shed prematurely. An unfailing cure found is to brush thickly over the needles the following compositions, No. 1 while they are still too tender for too large a dose of the sulphate, No. 2 later. The brushing should be effected twice a year:—

	No. 1.	No. 2.	
Sulphate of copper .	3 kilogs.	4·5 kilogs.	100 litres water.
Quicklime . .	3 „	3 „	
Fish glue . .	1 „	1 „	

The remedy at once proves that the disease is due to a fungus. Dr. Vuillemin of the Nancy University, a well-known mycologist, considers that the disease is caused by *Leptostroma Pinastri* (Desm.) and that the *Lophodermium* (*Hysterium*, Schrad.) *Pinastri*, to which Prantl ascribes it, is only a subsequent appearance.

As regards India, Sir Dietrich Brandis, now more than 15 years ago, started the selection and measurement of sample plots in order to determine the rate of growth of some of our trees which do not form a clear annual ring or form more than one ring in a year. It is time now to collate the results already obtained and to draw some general conclusions. In collating them care should be taken not to utilise the measurements of trees which either from suppression or lateral compression have been making little or no growth. What we want to ascertain is not the mean rate of growth of *all* the trees in a crop, but only of those few trees which are to form the mature crop or are to survive until they reach the size of felling maturity. Hence trees which have practically ceased to make any growth should not be measured at all except for the purpose of computing their contents in case it is required to find out the quantity of material standing on the sample plot.

Speaking of volume of standing stock reminds me that we have made the mistake of confining our attention almost exclusively to the measurement of diametral development. The omission should now be made good without delay. Starting, as we have done, with the experience of Europe at our disposal, let us not make the mistake of devising elaborate methods of treatment before we have any accurate idea of the laws of forest growth and production in India. If we knew these laws, we could at once build up a perfect system of sylviculture for ourselves, and in order to study and ascertain what these laws are, we need not wait until we have advanced any further in the mere empirical treatment and management of our forests. Indeed there is nothing to prevent, the necessary experiments being started and carried on in the most complete and systematic manner even in a country where forestry is only just being introduced. Unless we begin at once a complete system of experimentation and research, we shall soon have cause to regret our omission when, with the rapid development which the country is undergoing, we are called upon to treat our forests as intensively as they are now treated extensively.

It is obvious that the best agency for such research is the teaching staff of a forest school, provided of course that the staff is strong enough to have leisure for original research. But it is questionable whether the Dehra School with its 100 students divided into four classes and only 4 Instructors and a non-teaching Director who is at the same time Conservator of a circle, is strong enough for the purpose. For original research Germany stands easily first among the countries of Europe, and yet in Germany where the vacations aggregate nearly 5 months of the year, excursions are few and far between, and many professors have to deliver during term time only 3 one-hour lectures distributed over not more than two days of the week. I have heard complaints made by some of them that they have insufficient leisure for original research! At Nancy, where each professor lectures only 5 times a week, it has been considered necessary to have a separate officer for the Research Bureau.

It might be suggested that Divisional Officers and their Assistants and Rangers should carry on the necessary researches. The experience of the Bavarian Forest Department, which has its ranges, although equal in size only to most of our guard's beats, in charge of gentlemen possessing the highest general and special education and long experience, ought to condemn such a suggestion the moment it is made.

There is thus no alternative but to attach a special officer of standing to each Circle, who should be selected for his special qualifications. This may seem an impossibility, for the question at once arises where an extra officer for each Circle is to come from when the Forest

Divisions are undermanned. The obvious reply is that at present indeed *i.e.*, until Government is pleased to sanction the proposed reorganisation of the subordinate staff, the matter is an impossibility. But this sanction cannot long be delayed, and then with smaller ranges than we have at present, it will be possible to place more Extra Assistants in charge of Divisions, thus releasing, in each Circle, an officer of the Imperial Service for the important and essential business of research. Such an officer, once properly selected, should not be changed, but obtain all his promotions up to 1st grade Deputy Conservator without transfer. Later on when our revenue and, with it, forest business increases sufficiently to require more conservators for each province, the head of the Research Bureau should be an officer of Conservatorial rank, and have several assistants to help him, being at the same time head of the Working Plans Branch for his Province. The present system of examining and approving working plans and supervising their execution is evidently only a makeshift and a very clumsy makeshift, while the number that go up for approval each year can be counted on the fingers of one hand and the total number to be watched in execution is less than a hundred.

But until a special agency is available the interval can be profitably utilised by entrusting the Dehra School and selected officers elsewhere with the work of research, separate accounts of such work being submitted annually to the Inspector General, so as to ensure its being prosecuted regularly and systematically. Abstracts of completed observations with deductions would be printed in the Indian Forester and prove extremely useful and interesting.

G. I. C. P. O.—No. 177 R. & A.—600.—F. C. K.

APPENDIX SERIES

OF THE

Indian Forester,

REPORTS BY

E. E. FERNANDEZ, Esq.

Consr. of Forests.

PART III

PART III.

REPORT ON TOUR IN GERMANY AND SWITZERLAND.

1. Forestry in Bavaria : The Group System.
2. Forestry in Saxony with special reference to the Spruce Forests of the Erzgebirge.
3. Agriculture combined with Forest Regeneration, and Underplanting with Plenary Thinnings, in the Grand Duchy of Hesse.
4. The Black Forest in Baden, a peculiar system of the Group Treatment.
5. The Black Forest in Württemberg.
6. The Sihlwald Forest, Zurich, Switzerland. Model of forest management for a town municipality.

1. FORESTRY IN BAVARIA.

Of the several States of Germany which the Indian Forester may visit with profit, none possesses for him so much interest as Bavaria, for its 29,290 square miles of surface present every diversity of soil, climate and configuration to be found in Central Europe, so that every condition of forestry peculiar to that part of the European continent is illustrated there. And more than this. While every effort is made by the Bavarian Forest Department to secure the regeneration of its forests through the action of natural forces alone, the fullest use is made of artificial means to supplement the work of nature. I will, therefore, before describing the forests and systems of treatment which I have seen during my tour there, give a short account of the forest conditions in general of the State.

The country, forming two separate blocks, lies between 47° 16′ and 50° 41′ North Latitude and 7° 5′ and 13°50′ East Longitude. Its lowest point is on the Rhine in the Palatinate at 250 feet above the sea, the highest point in the Alps at 9,715 feet. Leaving out the block of the Palatinate, which is situated entirely in the Rhine valley, the country is divided into two almost equal parts by the valley of the Danube. The southern half rises by three successive broad terraces (the Swabo-Bavarian plateaux) to the Alps. The highest plateau contains several lakes, the largest of which are the Chiem See (74 square miles), the Starnberger See (25 square miles) and the Ammer See (16 square miles), while the middle plateau has numerous extensive bog lands. The northern half forms part of the highlands of Central Germany and is traversed from south-west to north-east by the chain of the Frankish Jura, which forms the water-parting between the Danube and the Main flowing into the Rhine. In the Danube basin lie the famous forest regions of the Boehmerwald and the Fichtelgebirge; on the other side of the water-parting stretches the great Spessart forest.

As regards climate, the mean annual temperature gets steadily lower and lower from west to east and from north to south. Whereas in the west, on the Rhine, the climate is almost a maritime one, in the south-east, even at a comparatively low level, it is distinctly alpine or sub-alpine. Leaving out the Alps, the mean annual temperature varies, according to the part of the country, from 42° to 50° Fah., the maximum rising as high as 84°-98° Fah., and the minimum sinking to *plus* 5° — *minus* 10° Fah. The daily range may attain 41° Fah. The mean annual rainfall varies from 10 inches in places sheltered from the wind to 38 inches in fully exposed localities, especially at the foot of the Alps. The first snowfall occurs sometimes as early as the third week of October, but usually in the period from the last week of October to the third week of November. The snow lies for various periods. The earlier falls melt within a few days. In January the ground is seldom covered anywhere for less than 15 days. The last snowfalls occur end of February to the beginning of March. The heaviest falls are from 8 to 17 inches deep. Hailstorms occur in nearly every month, but especially in the period from May to August.

The two statements below indicate the distribution of forests in the eight provinces or, as we should say in India, districts, according to the ownership and to the stock. They also show how richly every part of the country is endowed with forests.

Distribution of Forests according to Ownership.

DISTRICT.	Average of all classes of forests.	RATIO PER CENT. TO				
		Area of kingdom of total forest area.	TOTAL FOREST AREA OF			
			State forests.	Communal forests.	Forests belonging to other Corporations.	Private forests.
Oberbayern	1,342,384	35·5	42·5	3 0	1·2	53·3
Niederbayern	835,182	32·8	19·7	1·7	1·0	77·6
Pfalz	575,225	41·3	49 2	35·4	1·2	14·2
Oberpfalz	873,294	39·0	30·6	3·3	1·9	64·2
Ueberfranken	597,064	36·2	38·9	4·9	1·2	55·0
Mittelfranken	625,190	35·0	32·9	14·0	1·8	51·3
Unterfranken	772,807	39·0	32·8	36·6	2·4	28·2
Schwaben	576,340	25·3	31·0	16·7	3·8	48·5
TOTAL IN 1893	6,197,486	35·1	34·8	12·6	1·7	50·9
TOTAL IN 1883	6,189,193	35·3	34·3	12·3	1·6	51·8

Distribution of Forests according to Stock.

DISTRICT.	RATIO PER CENT. TO TOTAL FOREST AREA OF AREA UNDER								
	Spruce and silver fir.	Scots' pine.	Larch.	Beech.	Birch, alder and aspen.	Oak timber forest.	Oak coppice for tanning bark.	Other coppice.	Willow beds.
Oberbayern	81·2	10·4	1·0	3·1	0·9	0·3	0·0	2·7	0·4
Niederbayern	63·6	19·2	0 7	5·5	7·9	0·7	0·1	2·0	0·3
Pfalz	2·2	43·1	0·2	30 0	0·8	5·5	10·2	7·6	0·4
Oberpfalz	34·5	61·2	0·4	1·8	0 8	0·1	0·0	1·2	0
Ueberfranken	46 7	39·7	0 2	5·0	0·5	0·5	1·6	5·6	0·2
Mittelfranken	28·5	53·4	0·3	5·9	0·8	0·8	1·6	8·3	0
Unterfranken	8·6	25 1	0·8	28·3	5·9	5·9	7·1	21·8	0·5
Schwaben	70·6	8·5	0·4	7 3	1·1	1·1	0·1	11·7	1·0
TOTAL IN 1893	46·2	30·1	0·6	9·7	1·7	1·7	2 2	6·8	0·4
TOTAL IN 1883	46·6	29·8	0·7	9·6	1·6	1·6	2·2	7·2	0·3

It will thus be seen that 77 per cent. of the total forest area in 1893 was under conifers, and only 23 per cent. under broad-leaved trees. This large disproportion is, no doubt, to a great extent due to the artificial introduction of larch and the firs, especially the spruce, into areas that would naturally be stocked with inferior broad-leaved species; but it is principally the effect of the preponderance of mountainous regions and a severe climate in the case of the firs, and of the low sandy plains of the Palatinate in the case of the pine. The very low percentage of oak timber-forest as compared with beech is a consequence (i) of the great local demand for firewood and the high prices which prevailed until a few years ago, before coal displaced wood, and (ii) of the absence, until recent times, of communications which prevented export of timber beyond a very limited distance from the place of production.

The area of the State forests in 1893 was 2,155,359 acres or 12·2 per cent. of the total extent of the Kingdom. It would be interesting to know what proportion of this area is under each of the various kinds of treatment and what the figures of production are for each, but I have not been able to obtain this information, apparently because they have not yet been worked out in the Central Office at Munich, the reason being probably that the present is a period of change during which the originally large area under some system of clear felling is being for the most part rapidly brought under the system of regeneration under cover

The following four statistical statements will be found interesting:

I.—Financial Results for the 10 years from 1882 to 1891.

	1882.	1883.	1884	1885.	1886.	1887.	1888.	1889.	1890.	1891.	Annual average	Percentage of Total.
	£	£	£	£	£	£	£	£	£	£		
Revenue.												
From major produce	1,009,860	1,049,735	1,169,330	1,161,540	1,162,625	1,175,310	1,232,515	1,269,555	1,434,705	1,523,865		
,, minor ,,	40,550	35,965	46,610	47,655	54,915	48,415	51,055	52,070	49,870	47,650		
,, game	8,215	8,075	8,220	8,145	7,885	8,325	7,505	8,600	9,376	9,400		
,, floating and depôt dues	48,820	48 505	48,070	50,015	51,000	43,360	38,960	43,725	37,585	38,635		
Contributions from communes	2,915	2,900	2,905	3,150	4,140	4,590	4,745	5,065	5,245	5,425		
Rent of houses, fields, etc, let to officials					3,855	5,360	6,090	6,855	7,120	7,420		
Other sources	5,470	5,095	5,380	4,530	5,125	4,990	4,690	9,920	4,945	7,085		
Total Revenue	1,115,330	1,150,275	1,269,515	1,275,025	1,279,545	1,290,290	1,345,520	1,395,990	1,548,945	1,637,470	1,340,790	
Expenditure.												
Timber operations, including roads	293,895	300,840	305,020	309,316	311,570	334,145	324,270	333,350	348,315	592,490		
Transport dues and octroi	35,285	35,075	36,170	36,185	35,590	36,005	36,795	38,725	39 100	40,195		
Commutation of rights	4,965	45		-			...	.	15,030	10,665		
Purchase of forests									4,835	20,250		
Salaries and allowances	237,980	237,290	236,505	223,595	217,830	219,450	225,485	226,740	227,980	239,250		
Contribution to Treasury Department for collecting revenue and keeping accounts	13,690	14,280	15,755	15,855	16,010	16,820	16,790	17,615	19,750	17,635		
Other charges	48,785	47,195	43,565	52,840	53,985	61,680	63,700	64,835	75,420	82,525		
Total Expenditure	634,590	634,730	637,015	637,795	634,955	667,100	667,040	681,265	730,930	993,040	691,846	
Net Revenue	480,740	515,545	632,500	637,230	644,590	623,190	678 480	714,725	818,015	644,430	648,944	
Ratio of Expenditure to Revenue per cent.	57	55	50	50	50	52	50	50	47	61	51 6	
	Shillings	s.	s.	s.	s.	s.	s	s	s.	s.		
Per acre { Gross Revenue	10·51	10 84	11·96	12·02	12 06	12·16	12·68	13 15	14·59	15 43	12 98	
Per acre { Expenditure	5·98	5 98	6 00	6·01	5 98	6 29	6·29	6 42	6 89	9 35	6·70	
Per acre { Net Revenue	4 53	4·86	5 96	6·01	6 18	5·87	6·39	6 73	7 70	6 08	6 28	

II.—*Yield and value of material during the 10 years from 1884 to 1893.*

YEAR.	QUANTITY				VALUE OF			Productive area.	Value of yield per acre.
	Timber.	FIREWOOD			Timber.	Firewood.	All wood.		
		Split wood and billets.	Root stocks and dead and fallen wood.	Faggots.					
	Solid cubic feet.	Stacked cubic feet.		Hundreds.	£	£	£	Acres.	*Shillings.*
. . . .	45,531,047	81,174,311	6,739,038	165,661	729,786	488,300	1,218,086	2,068,746	11·78
1885	45,999,046	80,641,587	6,431,862	152,391	746,263	474,898	1,221,161	2,065,754	11·82
1886	44,554,221	81,999,153	5,819,635	153,529	723,850	487,457	1,211,307	2,064,423	11·73
1887	47,649,927	87,379,933	4,963,812	170,353	735,093	496,170	1,231,263	2,065,766	11·92
1888	48,566,057	83,299,447	5,375,957	165,550	795,591	485,615	1,281,206	2,066,239	12·40
1889	48,790,883	80,740,708	5,366,695	166,477	824,897	492,837	1,317,734	2,065,062	12·77
1890	52,617,874	83,134,645	6,190,987	166,786	971,167	517,119	1,488,286	2,065,059	14·42
1891	71,630,300	80,336,233	5,834,588	136,003	1,076,612	504,211	1,580,823	2,063,841	15·32
1892	82,402,653	86,841,446	6,295,623	150,578	1,240,811	544,543	1,785,354	2,065,124	17·29
1893	46,464,570	86,388,683	6,868,294	161,621	827,114	556,250	1,383,364	2,066,832	13·39
Annual average .	53,420,648	83,193,613	5,993,649	158,895	867,118	504,740	1,371,858	2,065,635	13·29

III.—*Improvements effected during the 10 years from 1884 to 1893.*

			1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	TOTAL.
Drains .	Length in miles		267	254	199	239	200	255	256	291	317	237	2,745
	Cost in £		1,917	1,658	1,302	1,640	1,136	1,495	1,328	1,717	1,910	1,405	15,507
Sowing and Planting	New .	Broad-leaved species, acres .	3,981	5,713	2,893	2,686	7,462	4,986	1,455	2,177	3,353	4,193	38,899
		Conifers, ,, .	13,536	13,689	12,881	13,161	13,262	13,626	12,328	10,048	11,460	12,081	125,962
	Repairs .	Broad-leaved species, ,, .	329	647	511	432	442	252	272	236	348	645	4,113
		Conifers, ,, .	5,644	5,471	5,834	5,140	5,449	4,774	4,712	4,201	3,864	4,144	49,233
	Total cost in £		23,846	24,082	19,966	20,742	23,816	21,525	20,795	20,987	25,863	28,004	229,616
Trenches and other protective works	Length in miles .		204	341	234	151	123	103	197	141	164	151	1,809
	Cost in £ . .		997	673	918	455	329	581	584	463	777	628	6,405
Roads .	New constructed .	Length in miles .	133	139	137	144	138	142	136	173	151	168	1,461
		Cost in £ .	16,890	17,432	17,150	18,123	16,486	19,382	16,247	20,381	18,219	20,907	181,197
	Old repaired . .	Length in miles .	3,088	3,064	3,285	3,421	4,053	4,155	4,302	4,354	4,874	4,883	39,480
		Cost in £ .	31,516	32,266	33,076	34,746	34,895	35,931	38,866	43,387	49,041	43,694	377,417

IV.—Purchase of Forests and Extinction of Rights, 1844-91.

PURCHASE OF FORESTS.					EXTINCTION OF RIGHTS BY MONEY COMPENSATION								REMARKS.
PERIOD.		Area in acres.	COST.		PERIOD.		Number of rights.	Involving an annual total of	CONSISTING OF			Compensation paid in pounds sterling.	
From	To		Total.	Per acre.	From	To			Timber.	Firewood.	Annual removal of ground litter.		
			£	Shillings.				Stacked cubic feet.					
1844	1861	80,256	544,628	135·7	1853	1883	23,581	6,907,991	1,798,254	5,109,737	5,850,071	1,064,463	I have not been able to obtain figures for successive periods in the case of compensation paid for buying out rights.
1862	1867	8,973	339,514	181·9	1868	1873	5,406	1,725,009	605,050	1,119,959	1,157,147	279,357	
1868	1873	7,078	38,977	110·2	1880	1885	2,826	691,057	182,724	508,333	548,531	146,465	
1874	1879	3,945	30,095	152·6	1886	1891	1,629	469,306	114,994	354,313	252,116	84,762	
1880	1885	2,449	19,323	157·9									
1886	1891	5,777	51,635	178·8									
Total for the entire period of 48 years.		108,478	1,024,172	197·9									

The salient points to notice in the preceding figures are :—

(*a*) The comparatively large area of State forests. France, which is more than seven times larger, possesses only 2,691,156 areas of such forests, or only 20 per cent. more.

(*b*) The high net revenue per acre, per annum, *viz.*, 6·28 shillings as the average of 10 years against less than 5 shillings made in France in 1894. The other large German States, it is true, show better results, but none of them have, like France and Bavaria, so large a proportion of high bleak mountain country.

(*c*) The high ratio of expenditure on roads to the total charges, *viz.*, 8 per cent. At this rate we, in India, ought to spend annually more than 12 lacs, whereas, although we have next to no forest roads, we spend a very much smaller amount.

(*d*) The comparatively low figure of 2·6*d.* per acre of the productive area per annum for outlay on sowing and planting, proving a much less extensive recourse to artificial methods of regeneration than in other German States.

(*e*) The comparatively large average annual outlay on purchase of forests (£21,337) and on buying out servitudes (£31,060). The Bavarian forests are still very heavily burdened with such rights, which in some cases, as in the Spessart, render even necessary operations, such as thinnings, impossible for a long series of years, thereby entailing irreparable loss of production, if no worse evil, and undue lengthening of the rotation. The continued exercise of the right to collect and remove the dead leaves that litter the soil has resulted in many instances in the sickening and premature death of whole crops consequent on the utter exhaustion of the soil.

A summary account of the organization of the Bavarian Forest Department will not be uninteresting and uninstructive.

The Head Office is located at the seat of Government at Munich and is the premier branch of the Ministry of Finances. It is composed of a Ministerialrath or Inspector General, who presides over all sections of forest business, and five Oberforstraths or senior Conservators who perform the duties of Deputy Inspectors General and divide the various sections between them, one of them being in official charge of Forest Surveys and Maps. The Inspector General and his five Deputies compose the Forest Council or College, which meets frequently to transact and decide the more important items of business. They are assisted in office as well as outdoor work, by two Forstraths or senior Deputy Conservators, one Forstmeister or Senior Assistant Conservator and a certain variable number of apprentices termed *Forstamts-Assistenten*, who hold a temporary position in the Department while waiting to be posted as junior Assistant Conservators.

The next grade of Controlling charge is the Conservatorship, of which there are eight, all co-extensive and synonymous with the Civil Districts. The Conservatorships are held by Oberforstraths.

Each Conservator's Circle is divided into smaller inspection charges, entrusted to Forstraths or senior Deputy Conservators or *Regierungs-Assessoren* or junior Deputy Conservators. These two classes of officers are purely inspecting officials.

Next come the Ranges, which are administered by Forstmeisters or senior Assistant Conservators. If the Range is too large or straggling to be looked after by a single officer, it is divided into two or more sub-ranges, one of which the Forstmeister himself attends to personally, the rest being given to *Forstamts-Assessoren* or junior Assistant Conservators under the orders of, and directly responsible to, the Forstmeister.

In all important Ranges the Forstmeister is given the help of one or more *Assistenten* or Apprentices.

All the above officials, from the Inspector General to the Assistant, constitute the superior staff of the Department, and all but the Assistants belong to the permanent establishment.

I have translated the German word "*pragmatisch*" by "permanent," but it means much more. A *pragmatischer* official is one who holds a certain position and certain rights (to pay, pension, etc.) neither of which are alienable so long as he does not retire of his own accord, or is not obliged to go away on pension on reaching the age limit or on becoming physically incapacitated, or does not become a criminal before the law and is declared by the convicting court unfit for further employment. In all other circumstances, even if there is no post for him to fill, he retains his rank, his full rate of pay and his right to earn pension. On reduction of establishments the State has no right to dispense with his services. It is in this sense only that the *Assistents* are not *pragmatisch*, for they cannot be dismissed without good cause; their service, while they are still *nichtpragmatisch*, counts for pension; and even if they never become *pragmatisch*, they are entitled to a pension, which is equal to thirty per cent. of their salary after the first year of service, with an addition of 2 per cent. for every subsequent year of service, up to the full amount of the salary, provided that when this is £120 a year or upwards the total pension cannot exceed nine tenths of it.

Widows and orphans of both *pragmatisch* and *nichtpragmatisch* officials receive pensions, which always bear a fixed proportion to the pay or pension of the deceased official.

The superior staff is thus recruited. Candidates must have passed through the highest class of a *Gymnasium* or High School. They proceed, first, to the Forest School at Aschaffenburg, the curriculum at which extends over two years. Having duly obtained the Diploma there, they attend a two years' course at any of the German Universities which possess a Forestry Faculty. They must then, if they have not already done so during their stay at the University, work for one year in a Bureau for Forest Research. In Bavaria, Württemberg and Hesse this Bureau is attached to the Forestry Faculty itself of the Universities of Munich, Tübingen and Giessen, and in Alsace-Lorraine the Officer in charge of the Bureau is *ex officio* a Professor of Forestry at the University of Strassburg as well as head of the Working-Plans Branch. These are the only four German Universities which possess a Forestry Faculty, so that students can always satisfy the condition as regards working in a Research Bureau while going through their University Course. All the preceding conditions being satisfied, they must go up to the University of Munich for the University Forestry Diploma. Their troubles are not yet over, for they have still to do two years' practical work in a Range, during the second of which they may receive some remuneration if employed in charge of a subordinate's post, and one year in a Conservator's office. They are now qualified to present themselves at the Central Forest Office at Munich for the Departmental Diploma. If successful, they may expect to be appointed as Assistents by the end of one year, on the occurrence of vacancies.

"Assistents," before they are appointed as Assessors, must obtain from the Forstmeister under whom they have served a certificate that they have proved their competence to administer a sub-range. As a rule, at least six years are passed in the "Assistent" class.

Once a person becomes an Assessor his promotion goes on purely by seniority up to the highest grade of Forstmeister.

Under present conditions he remains an Assessor for scarcely more than five years. For the classes above that of Forstmeister, selection, only tempered by seniority, is employed, so that a *Forstamts* (Range) Assessor (junior Assistant Conservator) can be promoted to Fortsrath (Deputy Conservator) without passing at all through the intermediate class of Forstmeister or senior Assistant Conservator. Thus the majority of persons entering the superior Forest Service cannot hope to rise above Forstmeister. It is for this reason, as will be seen in the next paragraph, that the Forstmeister's position, although it is only that of a Range Officer, is made as agreeable as possible.

The Range is *the* unit of forest administration and is the corner stone on which the entire organization of the Department is built up. The Forsmeister is the sole officer responsible for the selection, laying out, marking and felling of his coupes, the utilization, classification and sale of every class of produce, the preparation of the budget of the Range, the proposal and carrying out of improvements, etc.

The "Assistents" or Apprentices attached to him are merely his satellites to be put on any work or duties he pleases and responsible to him alone. Even the Sub-range Assessors, although holding a territorial charge, are responsible only to the Forstmeister, who can direct them in the smallest detail of their work, and, if a young, active man, over-confident of his own judgment and capacity and distrustful of those of others, can make their subordinate's life very unpleasant. Supreme over all his subordinates, he cannot himself be interfered with except after no inconsiderable circumlocution. Although his range is frequently inspected by the Deputy Conservator and pretty often by the Conservator and higher officers, still none of them can give him direct orders on the spot except in urgent cases. The Deputy Conservator has to report his views and proposals to the Conservator, and if the matter has not to go up to higher anthority, these views and proposals are considered in conference, to which the reporting and other Deputy Conservators are admitted, and it is only when an agreement is arrived at that any change in the procedure adopted by the Forstmeister can be ordered. The same degree of circumlocution obtains also with the Inspecting officers of the Inspector General's office. The result is that the Forstmeister enjoys an extraordinary amount of independence, which helps to reconcile a man of some age and long service to his very low position in the official hierarchy. As no one can reach the position of Forstmeister except after a long and severe theoretical and practical training and a service of at least 11 years, this unusual degree of independence has apparently no mischievous results.

A few years ago the title of the Range Officer was Oberförster. As a Forster (*Anglicè* forester) belongs to the subordinate ranks, the appellation did not sound very dignified and was accordingly replaced by the present more high-sounding one. In furtherance of the policy of making the Forstmeister contented with his lot, his headquarters are established in the largest village, borough or town near or in the midst of his forests, and a large comfortable house is built for him for which he pays the nominal rent of £5 8*s*. per annum. With the house he gets up to 10 acres and even more of field and garden land at a rent of from 6 to 21½ shillings an acre according to the quality of the soil. He receives either actual carriage hire for his excursions or a fixed sum of £60 a year as horse allowance, which, with the field land, enables him to keep a carriage and a pair of horses. He is permitted to hold the shooting and fishing lease of his range, and even without the lease he enjoys the free run of his forests for shooting purposes, selling the flesh of the animals shot on State account, but keeping the head as trophy and receiving so much for each animal slain.

The Range Assessors are also granted the privilege of occupying houses belonging to the State and cultivating fields, gardens and orchards. They pay the same rent as Forstmeisters.

The strength of the superior staff outside the Head Office and the size of the various Circles, Divisions and Ranges are given in the statement below :—

CIRCLES.				DIVISIONS.				RANGES.				
		Number of Officers attached.				Number of Officers attached				Number of Officers attached.		
Name.	Area in acres.	Conservators	Apprentices.	Number.	Average area in acres.	Senior Deputy Conservators.	Junior Deputy Conservators.	Number.	Average area in acres.	Forstmeisters (Senior Assistant Conservators).	Assessors (Junior Assistant Conservators.)	Apprentices.
Oberbayern . . .	774,990	1	5	10	77,499	9	1	61	12,705	60	19	24
Niederbayern . .	180,986	1	2	4	45,216	3	1	24	3,771	24	10	12
Pfalz	608,826	1	1	7	7[illegible],092	4	3	61	8,376	61	28	19
Oberpfalz . . .	344,134	1	3	6	57,356	6	0	43	8,003	43	16	15
Ueberfranken . .	279,777	1	2	6	46,629	4	2	46	6,082	46	19	16
Mittelfranken . .	313,926	1	3	4	78,481	3	1	42	7,474	42	19	15
Unterfranken . .	581,517	1	4	7	83,074	6	1	63	9,230	63	22	25
Schwaben . . .	314,311	1	2	5	62,862	4	1	36	8,731	36	13	11
Total .	3,399,311	8	22	49	67,316	99	10	376	8,799	375	141	137

The Ranges are divided into beats comprising from 900 to 1,800 acres in charge of some member of the subordinate staff, which consists of *Försters*, *Forstwarts*, *Forstgehilfs* and *Forstaufsehers*, who belong to the regular organised establishment and of *Waldwärters* The Försters alone are *pragmatisch*. The first four classes are recruited from lads trained at one of the five existing secondary Forest Schools (*Waldbauschulen*), while the Waldwärters are mere peasants or workmen, who are put in charge of unimportant beats, receive daily wages and do not give all their time to their forest duties. The Försters and Forstwärters are given most comfortable houses, with garden and field land, at nominal rents.

The pay and allowances of the diffeıent classes and grades is given below in pounds sterling:—

CLASS.	ANNUAL SALARY.					Yearly allowance.	Daily Travelling Allowance.	REMARKS.
	1-5	6 10	11-15	16-20				
	Year's service in class.							
Ministerialrath . .	351	369	387	405		36	19s	In rising from class to class no one actually reaches the highest grade of the lower class before he is promoted to the upper. Foresters can of course never hope to be promoted into the Upper Service, and Forstmeisters not destined to get a controlling charge, go on up to the last grade of their class.
Oberforstrath . . .	306	324	342	360	..	27	14s.	
Forstrath . . .	246	264	282	300				
Regierungs-Assessor .	195	213	231	249	...	21	11	
Forstmeister . . .	186	204	222	240				
	1-3	4-5	6-10	11-15	16-20			
	Year's service in class.							
Range Assessor . .	114	132	150	159	168	9	9s.	
Assistent . . .	75	84	93	102	..	...	6s.	
	1-3	4-5	6-10	11-15	16-20			
	Year's service in class.							
Förster	94½	103½	112½	121½	130½	9	7s.	
Forstwärter . . .	69	78	87	91½	...	5	6s.	
Forstgehilfe . . .	54	60	63	...	...	...		
Forstaufseher . . .	42	45	...	...	...	...	3s.	

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* This allowance is in addition to actual railway, steamboat or carriage fare, but is given only for authorised journeys of 2 miles beyond head-quarters. In the case of Forstmeisters and inferior Officials the journey must extend outside of range, sub-range or beat, as the case may be.

THE FOREST SYSTEM OF THE SPESSART.

The region of the Spessart, situated in the District of Unterfranken, occupies the north-western corner of the Eastern Block of Bavaria, not far from Frankfort-on-the-Main, into which tributary of the Rhine it is drained.

It is formed by an upheaval of the variegated sandstones (in German *Buntsandsteins*, in French *Grès bigarrés*) of the Trias Series, and offers the usual topographical character peculiar to that formation, *viz.*, low, gently sloping, rounded hills separated by broad, open valleys. The mean elevation above the sea is 1,480 feet, the lowest point being 1,250 and the highest, the peak of the Geyersberg, 2,024 feet. The climate is specially suited for broad-leaved trees, the oak (*Quercus sessiliflora*) being able to attain a height of 100 feet and upwards, even on the top of the Geyersberg.

The weathering of the variegated sandstones produces a loose loamy, sandy soil, varying from a foot to 15 feet in depth. Under close forest the soil holds moisture fairly well: without such cover it remains extremely dry. The region contains no large streams, there being merely narrow brooks running at the bottoms of the valleys. Except under a complete leaf-canopy, the soil gets rapidly overrun with bilberry and heather and becomes so dry and impoverished that the trees grow crooked and misshapen.

The Spessart has always been pre-eminently a forest region, and even at the present day the entire face of the country is heavily wood.

For centuries it was renowned for its oak, which grew in abundance everywhere. But in the absence of roads timber was of little value, especially in the central parts of the region, and beech furnished a much better firewood. The oak was, therefore, allowed to rot and die standing, and the openings thus caused in the forest were rapidly filled up by the more shade-enduring and quicker-growing beech. Later on, when the system of clear-felling in successive bands was adopted, although the oak was able to sow the ground along with the beech, still as no cleanings or thinnings were ever made, the beech soon outstripped its companion, which was able to survive only where the conditions of soil and aspect were exceptionally favourable for it or were equally unfavourable for both species.

So long as firewood was the produce principally demanded, all this was no drawback. But with the advent of coal and the opening out of communications, the conditions were entirely changed and it became urgent to substitute for the system of treatment then in vogue one that would furnish the largest possible quantity of the most valuable timber. Accordingly, towards the close of the last century, a special Commission was appointed to study the subject and devise the system required. Owing no doubt to the troubled period which followed the breaking out of the French Revolution nothing seems to have been done until in 1814, when the Spessart passed under the Bavarian régime. Since that event the cultivation of the oak and its re-introduction in those places whence it had been completely or all but driven out, has been the main purpose of forest management.

First of all, the system of serial regeneration fellings (preparatory felling, seed-felling and after-felling) was employed, but, as was to be expected in those early days, no cleanings were thought of, much less attempted. Here and there, where numerous oaks came up together and grew up into a close group, this species survived; but elsewhere people found to their dismay that the numerous oaks that they had seen come up singly in the midst of the beech in the regeneration areas had all disappeared by the time that the young crop had attained the pole stage and was for the first time open enough to be entered and examined.

To remedy this state of things it was decided that there remained only two alternatives to adopt; either to head down as often as was necessary the obnoxious beech or to raise the oak in groups. To be on the safe side it was resolved to do both. It was, however, soon discovered that the first remedy, though excellent in theory, was impossible in practice. It was beyond human power to come so often and save the millions of oak hidden away under the beech, which grew up again like weeds as soon as it was cut. The second remedy was not much more successful, for most of the bouquets and groups were too small and suffered the same fate as the scattered oaks before the pole stage was reached.

Attempts made to regenerate artificially met at first with no better fate. Generally acorns were sown in lines, but sowing was also effected in bands, and likewise in strips running through young regeneration of pure beech. This last was soon given up for reasons that are obvious. The sowing in lines was effected over patches, the size of which was increased from year to year; and among other parts of the forest, this system was also tried in those areas which were soon to be felled, and in this case the rule was adopted, which is still in force, of sowing with oak in the aggregate one-half of the total area over which the mixture of oak and beech was desired. The reason for the numerous failures that occurred was the bad choice of sowing sites; so much confidence was felt in ultimate success that it was proposed to sow up with oak even the parts under Scots' pine, as soon as the pine was to be cut.

It must be admitted that the present generation of foresters had before them a rich harvest of experience, extending over more than half a century, from which to select in drawing up their plan of procedure. What this procedure is, is clearly summarised in the following words of Herr Dotzel, the able and successful Forstmeister of Rothenbuch :—

"The oak must be introduced into the new generation entirely pure either in patches of at least three-fourths of an acre or over large plots. Should beech now enter into mixture naturally after the oak is established, but while it is still young, the result will be very favourable for this latter; but then the beech will have to be mercilessly cut back or headed down as often as such operation is required until the oaks meet their crowns overhead. Should, however, the beech fail to put in an appearance and form in this manner an understory, the leaf-canopy constituted by the oak will begin, at the age of 40 years more or less, to open out and the ground to cover itself with weeds. So soon as this occurs, beech must be underplanted.* As oak thrives only in soils of good quality, the poorer soils should be stocked with conifers raised in the midst of beech, or, such mixture being impossible, with conifer alone."

How this system is worked out in its details will now be described; but before this is done it is necessary to give a few figures showing the rate of growth of the species cultivated. For a very exhaustive examination of the rate of growth of the oak, Professor Robert Hartig's remarkable article entitled "*Untersuchungem über Wachsthumsgang und Ertrag der Eichenbestände des Spessartes,*" which appeared in the 1893 volume of the "*Forstlich-Naturwissenschaftliche Zeitschrift,*" published at Munich, should be read.

The figures in the following statement are extracted from a manuscript report giving the results of measurements made in more than 200 sample plots. They refer only to the standing stock and are reduced to the acre as unit of area.

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* It is not in Germany alone that the immense difficulty of protecting oak against suppression by associated beech has been experienced. In the forest of Haye, near Nancy in France, the system applied for centuries was that of coppice with standards and under it the oak flourished in abundance everywhere. About seventy years ago Parade brought back with him from the Saxon, school of Tharandt the so-called *Ré-ensemencement naturel avec éclaircies* (as if any system of high forest treatment with natural regeneration excluded thinnings!). In the enthusiasm created by the teaching of Parade for this "*Système classique de haute futaie*" the old treatment was abolished and the "conversion" of the forest into high forest under the new system was undertaken. If oak throve before, much more, it was confidently asserted, would it thrive under the new treatment, which was to be an unfailing panacea for all the ills theretofore experienced in forest management. All of course went on well as long as it was a mere matter of allowing the existing coppice crops to grow on beyond the age at which they had been cut before. But when the crucial time came for creating the new seedling generation, it was found that although oak did not entirely fail to sow itself, no amount of cleanings and thinnings as taught heretofore, could save the oak from the beech. At last the following expedient, a real *confessio paupertatis*, has been adopted. It is nothing more or less than the complete banishment, by cutting down and, if necessary, also pulling up by the roots, of the beech from over patches of at least $\frac{1}{12}$ acre wherever the oak stands in sufficient abundance to form later on a group. Thus the only difference between the Spessart and the Nancy systems is that whereas in the one the oak is kept free of the beech *from the very beginning*, in the other the beech *is allowed to establish itself first and is then got rid of*. Which system is better time will soon show.

Age.	Height.	Mean annual height increment.	Mean diameter of stems.	Number of stems.	Total contents of standing crop.	Mean annual increment of volume.	REMARKS.
Years.	Feet.	Inches.	Inches.		Cubic feet.	Cubic feet.	
Pure oak (the first plot [illegible] partly [illegible])							
84	69·2	10	7·9	905	4,110	48·9	*N.B.*—Only the contents of trees actually standing is included in this statement, no account being taken of produce removed before the measurements were made.
94	68 9	9	8·8	794	3,976	42·3	
250	87·2	4	17·9	236	7,593	30·4	
Pure be[illegible]							
60	66·3	13	6·6	1,195	3,845	64·1	
83	87·9	12	9·8	680	6,426	77·4	
86	82·3	11	8·6	836	5,808	67·5	
92	77·7	10	9·2	801	5,917	64·3	
95	88·6	11	11·1	576	7,475	78·7	
100	92·2	11	11·5	484	6,937	69·4	
104	71·5	8	9·3	604	4,834	46·5	
Pure [illegible] Pine [illegible] and [illegible]							
42	55·5	15	7·2	1,540	3,845	91 6	
44	46·2	13	6·9	1,555	3,640	82·7	
48	54·1	14	8·2	1,308	4,596	95·7	
50	53·8	12	8·2	1,224	4,761	95·2	
Pure spruce, the first plot sown and planted the other only sown							
45	75·4	20	7·2	1,440	6,977	155·0	
65	96·8	18	10·4	937	11,669	179·4	
Mixed Pine (65 per cent) and spruce (35 per cent), all hand sown.							
50	58·0	14	7·8	400	3,911	78·2	
55	62·3	14	7·0	583	2,246	40·8	

Nearly all the figures in the next statement are taken from Dr. Robert Hartig's paper referred to above. It is a pity that the intermediate yield obtained up to date of measurement is known only in one case.

LOCALITY.	Age of crop.	Number of stems per acre.	Height of crop.	DIAMETER OF Stem.		Contents of standing crop per acre.	Material already removed per acre.	Total production per acre.	INCREMENT PER ACRE.		REMARKS.
				Thinnest	Thickest				Current annual.	Mean annual.	
	Years.		Feet.	Inches.	Inches.	Cubic feet.	Cubic feet	Cubic feet.	Cubic feet.	Cubic feet	
Rohrbuch, Rohrbrunn Range (not yet underplanted with beech).	33	6,950	32	1·2	4·3	1,216	?	?	74·2	29·7	
Bauersacker, Rothenbuch Range (underplanted with beech at age of 39 years).	48	1,640	50	3·2	7·5	2,545	?	?	78·5	37·1	
Weissenstein, Rothenbuch Range. (Thinned and underplanted with beech in 52nd year).	66	1,341	60	4·1	9·2	2,874	?	?	?	43·5	
(Same area as preceding just before being thinned a second time). oak .	92	940	72	6·5	11·4	5,793	?	?	98·3	62·9	
beech	40	4,060	33	0·4	4·1	301	?	?	?	7·5	
(Same area as preceding 6 years after second thinning). oak .	98	609	62	5·9	15·0	5,097	?	?	89·1	46·0	
beech	46	?	?	?	?	?	?	?	?	?	
(Same area as preceding 2 years later). oak .	100	600	63	?	?	5,579	2,432	8,011	?	80·1*	*None of the figures in the last column except this are of any real utility, as they do not include at all the material already removed.
beech	48	?	?	?	?						
Eichhein, Rohrbrunn Range (never underplanted with beech; oak almost pure)†.	90	649	73	5·1	12·2	3,682	?	?	46·7	39·8	†This plot compares badly with the preceding one at 92 years of age, owing no doubt to the absence of the beech understory.
Geyersberg, Rohrbrunn Range (never underplanted with beech; oak almost pure).	216	213	98	12·2	26·0	8,124	?	?	44·9	29·0	

The succeeding table gives the mean rates of growth in height of the various species employed in the Spessart, silver fir being omitted, as it is too recent an introduction :—

Age years.	Oak.	Beech.	Pine.	Spruce.	Larch.	Age years.	Oak.	Beech.	Pine.	Spruce.	Larch.
5	...	2·4	2·9	2·9	3·1	70	51·5	64·3	71·2	89·4	...
10	4·7	4·9	7·7	6·5	10·8	75	...	67·1	73·5	92·3	...
15	...	9·8	16·5	12·9	19·4	80	53·4	70·4	75·7	95·4	...
20	15·6	16·7	23·4	21·6	27·2	85	...	71·8	79·2	98·0	...
25	...	23·0	32·3	32·1	33·8	90	...	73·4	82·6	100·1	...
30	24·2	30·6	39·9	42·1	40·3	95	...	75·0	...	101·9	...
35	...	35·8	45·0	50·5	46·6	100	...	78·0	84·7	...	...
40	34·8	41·0	49·8	57·8	52·5	105	...	80·2	...	...	...
45	...	47·6	52·0	64·1	58·1	110	...	81·7	86·4	...	...
50	41·6	52·3	57·7	68·7	63·3	115	...	83·0	...	...	...
55	...	58·4	60·7	75·4	67·6	120	...	84·9	88·0	...	...
60	44·9	61·7	66·3	81·2	71·2	125	...	85·9	...	...	...
65	...	63·8	68·8	86·5	...	130	...	86·9	...	...	...

On comparing the figures given on page 17, as far as they go, with those in the preceding statement, it will be seen that the former are considerably in excess. The discrepancy is, no doubt, due to the measurements whose results are entered above having been made in crops standing on poor soil and grown in extremely dense thickets. I therefore give below a statement in which, besides repeating the figures given for oak and beech in the two preceding tables, I have entered the results obtained by Doctor Robert Hartig in his special researches.

Age.	OAK.					BEECH.		OAK.	
	Figures from page 18.	Figures from immediately preceding statement.	Doctor Robert Hartig's figures.			Figures from immediately preceding statement.	Dr. Robert Hartig's figures for rapid growth.	Metzger and Zuber, Rothenbuch.	
			Pure oak forest, Geyersberg, Rohrbrunn.		Metzger and Zuber, Rothenbuch.			Dr. Hartig's figures.	
			Rapid grown.	Moderately rapid grown.				Age.	Height.
Years.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Years.	Feet.
10	...	4·7	11·3	8·2	...	4·9	9·2	160	75·8
20	...	15·6	24·6	21·0	12·8	16·7	23·0	180	79·0
30	29·1	24·2	36·7	32·1	...	30·6	36·7	200	82·5
40	41·7	34·8	47·2	42·3	29·5	41·0	46·2	220	85·8
50	52·1	41·6	55·4	51·2	...	52·3	58·4	240	89·6
60	55·6	44·9	61·0	57·1	45·9	61·7	67·9	260	92·3
70	63·6	51·5	64·3	60·7	...	64·3	76·3	280	94·4
80	67·0	53·4	67·6	63·6	53·5	70·4	83·3	300	96·1
90	70·4	...	70·2	66·6	...	73·4	87·6	320	98·7
100	73·0	...	72·5	69·5	61·0	75·0	90·6	340	101·0
110	...	...	74·5	71·8	...	81·7	92·5	360	102·3
120	...	...	76·1	73·8	68·2	84·9	94·8	380	103·6
130	...	...	77·7	76·1	...	86·9	95·8	400	105·0
140	...	...	79·0	77·7	72·5	...	96·8	...	...

Here then we have figures which show that when the soil is really of high quality, as it must have been in Geyersberg from the very beginning of the life of the present crop, the oak has nothing to fear from the beech*, being a quicker grower up to beyond 40 years, a period quite long enough to enable it to keep down the beech until it has attained its full height. On no other assumption can be explained its easy predominance there over an area of nearly 2,000 acres in a single block, when we remember that thinnings or other saving and improvement operations had not even been so much as dreamt of 200 years ago; so that the existing trees are those which survived simply because they were the strongest.

A comparison between the figures in columns 2, 4 and 10 of the immediately preceding statement and a study of the Weissenstein crop, mentioned on page 18, justify the belief that under the present method of treatment the oak will attain a height of from 100 to 120 feet, with a clean bole up to 70 feet long, by the time it is 300 years old. At the same age the diameter at breast-height will measure from 3 to 4 feet, for naturally only about 10 of the very best trees per acre will be preserved up to that age. With 10 such trees per acre the Weissenstein area already mentioned will yield at 300 years over 4,000 cubic feet of oak and at least twice that quantity of beech, and if to this the intermediate yield be added, the annual production per acre will not be less than 100 cubic feet.

The forests of the Spessart are so heavily burdened with rights which fetter their treatment and management that a description of the detailed treatment cannot be understood without a knowledge of those rights. The villagers are entitled—

1st.—To pasture their cattle and pigs and to remove for home consumption the ground litter of dead leaves. Fortunately half the entire area is free from this destructive† servitude, and of the other half only one-eighth, opened successively in rotation,

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[*] In the forest of Champenoux near Nancy in France, the oak growing on a rich loam, although regenerated by means of self-sown seed simultaneously with the beech, precisely as in the forest of Haye (see foot-note on page 16), has no difficulty in contending with the beech, as it grows, during at least the first 40 years, quite as fast as, if not faster than, this latter species.

[†] How fatal to forest growth the practice of removing the litter of dead leaves is, will be seen from the following experiments. Three plots, measuring each about one-third acre, touching one another, and similarly stocked and under similar conditions of growth, were placed under observation. In all three the dead and fallen leaves had been removed regularly every six years, the last of such occasions being in 1858. After the commencement of the experiment in 1862, the covering of dead leaves was removed every year from one of the plots, only once every six years from another, and not at all from the third. The total quantity removed from the first plot in the 27 years from 1862 to 1888 weighed 80,870lb, while the three removals effected from the second in 1875, 1881 and 1887 (the three previous removals had not been weighed) scaled together 11,466lb. Measurements showed that in the fourteen years from 1862 to 1875, the stock in the third plot had put on 184½ cubic feet more wood than the first and 2½ cubic feet more than the second, while during the subsequent period of thirteen years, from 1876 to 1888, the corresponding figures in favour of the third plot rose respectively to 259½ and 60 cubic feet, thus proving not only that the soil in it had continued to improve, but that the soil in the other two plots went on from bad to worse. The figures given above do not express the whole mischief, for in these two latter plots, especially in the first, there were sickly and dying trees, and some had already died and been removed, unknown, by the right-holders, so that it was not possible to bring them into account. The difference in the condition of the three plots is most striking, and it is certain that the first of them will soon have left in it only a few scattered miserable trees. The result of the experiment proves the wisdom of lengthening the rotation of removal from six to eight years.

is subject to its exercise in any one year. On account of the manure they yield, cattle are, happily for the forest, stall-fed.

2nd.—To remove for home consumption only, without any restriction, all dead and fallen wood, measuring more than 3½ inches in diameter.

3rd.—To appropriate, also for home consumption only, all wood, the produce of fellings, measuring not more than 2 inches in diameter.

I will now describe in more detail than has been done on page 15, the method of treatment at present followed in the Spessart.

On all protected slopes and even ground and on all aspects having a southerly or westerly outlook, wherever the soil is of fairly good quality, the intention is, whatever the present composition of the stock, to grow mixed oak and beech forest. To this end, where the crop is ripe for the axe, the plots or belts to be stocked with oak are selected and marked out. If the oak is to be introduced by plots, these are made more or less square and from 1½ to 10 acres in size and are disposed with regard to the rest of the area like the squares of a chess board. If bands are to be adopted, these are generally run up and down the slopes and given a width of at least 250 feet. Over the plots or patches, as the case may be, everything is felled except about 60 trees per acre, consisting of as many growing promising oaks as can be found (very few indeed), the rest being tall, long-boled, narrow-crowned beech. These last are preserved only as nurses, not at all as seed-bearers. Every bit of advanced growth, save the exceptional promising seedlings of oak sometimes met with, and all weeds are pulled up by the roots. The removal of this advance growth is all the more necessary as they consist entirely or almost entirely of beech.

The ground is now sown with acorns in lines about 40 inches apart. The sowing is thus effected. A number of workmen, as many as 60, form line with hardly more than elbow room between them, each armed with a sack of acorns and a spear-shaped dibber about 18 inches long, handle included. As they move forward while working, the line is carefully maintained. The dibber is pushed into the ground obliquely about 6 inches, the soil is lifted up by leverage, the dibber withdrawn, an acorn dropped into the hole, and the soil pressed back with a single movement of the hand. About 486 litres (1 litre = 160—180 acorns) are sown per acre, and as nearly every acorn germinates, the seedlings in each line come up only a few inches apart from each other. The daily wage paid is from 20*d.* to 2*s.* for a man and 1*s.* for a boy 14-15 years old. Very few hands receive 2*s.* Sixty men sow nearly 10 acres in a day.

At the age of three or four years the seedlings are considered to be established and all the nurse trees, except, if they exist, a few of the still growing, promising oaks, are removed. By the age of ten years the lines of young oaks meet and form a complete thicket. Until they do so, annual weeds, principally several species of *Senecio*, come up very thickly. In some ranges they are pulled up every year, but in others they are considered harmless, and even to a certain extent beneficial for the shelter they afford. That they do no harm is amply proved by results.

When the nurse trees are felled, the small blanks where the sowings have failed are filled up, very rarely with oak transplants, nearly always with spruce three years old. Experience has shown that failures are due principally to the unsuitability of the soil at those points. Oak refills are therefore subject to suffer the same fate as the original seedlings, whereas the spruce thrives in soils in which the oak merely languishes.

The reason why the oak is sown so thick is to give it complete immunity from invasion by the beech. As the State has, in any circumstances, no right to any piece of wood 2 inches and less in diameter, cleanings are out of the question, for they would be all expenditure without a single farthing of counterbalancing revenue, since the villagers do not care to take the trouble of cutting thin saplings for their requirements, when they can get as much small wood 2 inches and under in diameter as they want from the State fellings in older crops, and they know that, by waiting a few years, they can get from the younger crops, for the mere trouble of picking it up, dead and fallen wood up to 3 inches in diameter. Thus before the dread of unremunerative expenditure the forester finds himself under the necessity of leaving all crops to themselves for the first 40 years of their existence. During the latter 30 years of this period the stems are so densely packed together that they make very little growth, even in height. I have seen numerous oak thickets 20—25 years old that are scarcely 18 feet high. On the other hand, sparser sowing would, it is feared, delay the meeting of the oaks over the ground too long to prevent beech introducing itself in the meantime in their midst and getting away above them.

Column 4 of the first Table on page 19 shows what results the better soils of the Spessart can yield, and it seems to me that all is not quite right when thickets 20—25 years old are not more than 18 feet high. It is a question deserving consideration whether a small outlay, unremunerative though it be at the time, will not repay itself later by more active growth and the consequent shortening of the rotation. A combined cleaning and thinning operation restricted to, say, 100 equally distanced points per acre, would cost very little, but have the effect of doubling the rate of growth of more than 200 stems per acre, the real trees of the future. In the densely-packed crops in question, it is the dead equality of growth that hurts. Enable three or four stems at each of 100 evenly scattered points per acre to shoot ahead, and they will always keep the lead and enjoy unchecked development, while the mass of the crop, still preserving its dead level of growth, will continue to maintain the complete leaf-canopy required to preserve the soil and to keep out an invasion of beech. Such an operation, made in the 16-18th year of a crop would scarcely cost 1*s.* an acre.

To come back, however, to the method actually followed. Under the action of the unaided struggle for existence the crops go on thinning themselves until towards the age of 40 years or thereabouts, they are so clear that the ground begins to cover itself with bilberry bushes. This is a sign that enough light reaches the soil to introduce an undergrowth of beech. Accordingly beech seedlings 5-6 years old are put down 40" × 40". In the course of 10 years or so these are fully established. The oaks above are now strongly thinned to give them the full amount of growing room they require and the beech at once spreads out and completely covers the soil. In another 10-15 years the intervals between the oak stems, which have by this time lost all their lower branches, are completely filled up by the beech, and from this moment onwards the forest grows up rapidly and well. The oak is now about 70 years old and the beech 30, and the crop fit to be thinned at frequent intervals, from five to ten years according to the discretion of the Forstmeister, who is deemed to be the best judge of their necessity and of their distribution in any year over the different component crops of the forest. The annual yield of the thinnings is estimated at a certain figure in the working plans, but this figure is nothing more than an estimate and the Forstmeister cuts out what he thinks should be got rid of. Thus, for example, in the Rohrbrunn Range the Forstmeister finds that the vigour of development of the crops has been very much under-estimated in the working-plan with the result that he obtains just double the figure therein given.

The thinnings touch very little in the beech understory until it is about 60 years of age. Here also the right-holders' title to wood of a certain maximum diameter comes in as a strongly influencing factor.

The beech is to be all cut out at the age of 120 years, which is also the rotation fixed for the associated spruce. At this time the oak trees will be 160 years old and will have lost their tendency to develop epicorns; moreover, there will be already on the ground a complete advance growth of beech which will shoot up at once the moment the upper beech crop has been removed.

The rotation for oak has been fixed at 300 years. If this figure is maintained, the oaks still standing at the close of the second beech rotation will require another 20 years to reach their exploitability; but by that time the advance growth of beech which is sure to be present will have attained too strong a development to be got rid of, except at a prohibitive cost, and thus render the regeneration of the oak a practical impossibility. The probability, however, is that the growth of the oak will be more rapid than is now expected and a shorter term than 300 years will suffice. Moreover, if the present tendency for a fall in the demand for, and price of, large oak timber continues, it will be found necessary to curtail the rotation.

So far as regards the plots and bands containing oak. The intervening plots and bands are left under beech worked on a rotation of 120 years. As a complete advance growth of this species is always found on the ground even before the end of this rotation, there is nothing to do but fell all the old crop at the same time that the nurse trees are removed from over the plots and bands of oak. Where the advance growth is a little sparse, advantage is sometimes taken to interplant conifers on account of the superior value of their timber. The conifers used are chiefly spruce and larch, sometimes silver fir, which last enjoys more immunity than any other indigenous conifer against insects and fungus diseases. The rotation for the conifers is the same as that for the beech.

The advantage claimed for these large plots and broad bands is that they stand out clear from one another and, being thus impossible to be overlooked, receive each the full care it requires. They also make it possible to bring within the oak area all the best patches of soil. The size of a plot not being fixed nor limited to a certain maximum, all the best sites can be selected for the oak. The most carping criticism cannot find anything to object against this procedure.

On cold aspects and on poor soils, where oak would be a failure, conifers take its place as the principal timber-yielding species; but except on the very poorest soils, on which there is no alternative but to raise pure Scots' pine, beech is always made to constitute, as it were, the matrix of the leaf-canopy, its presence in this wise being an essential condition not only for the improvement of the soil and the maintenance of its fertility, but also for preserving the conifers against the ravages of insects. Bavaria has had too severe a lesson to willingly create any more artificial forests of pure conifers and thus foredoom them to destruction.

The conifers are all planted, the spruce and larch at three years of age, the silver at 5-6, and the pine at 1. Here there is no underplanting, all the companion species being regenerated simultaneously, although silver fir, by reason of its delicate infancy, may be put down before the old crop is felled. The rotation is for all species 120 years. The adoption of special plots and bands is unnecessary, the main point being merely to adapt the species to the soil.

The two most interesting ranges to visit are Rothenbuch and Rohrbrunn, both situated in the heart of the Spessart.

Rothenbuch contains 8,616 acres (all State forest), of which 99 acres consist of meadow land, roads, houses, and unproductive patches. It is divided into five beats in charge respectively of two foresters, two *forstaufsehers* and one *waldwärter*. The Forstmeister has the services of an *Assistant*. The stock is all high forest composed as follows :—

Oak pure in larger or smaller groups . . .	1,730 acres.
Beech with a few scattered bouquets or individuals of oak and conifers	5,552 „
Conifers pure	1,235 „

The annual yield, fixed on the double basis of area and volume, is as under :—

Final yield	Oak . .	78,936 c. ft.	=367,463 c. ft.	=43·1 c. ft. per acre.
	Beech, etc. .	288,527 „		
Intermediate yield, all species	. .		136,098 „	=27°/₀ of total yield.
	Total .		503,561 „	=59·1 c. ft. per acre.

The very low percentage of the intermediate yield is explained partly by the absence of early thinnings, principally by the present character of the stock, which contains a large proportion of old open wood, a very large proportion of young wood, and very little middle-aged wood. The Revenue and Expenditure are, in round numbers, £8,500 and

£2,000 respectively, the net revenue being thus £6,500 or 15*s*. 3*d*. per acre. The expenditure is thus distributed :—

	£
On timber operations	750
„ roads and communications	600=30°/o of whole.
„ cultural operations	750=7°/8 „
„ salaries, etc.	500=25^8/o „

The oak yields 65% timber, the beech only 15%. The conifers are still too small to furnish any appreciable quantity of timber. The prices obtained are as follows :—

Oak	1st class logs		30–40*d*. per cubic ft.
	2nd „ „		7—30*d*. „
	Large spars		11—18
	Small „		4 11
Beech	Timber		4–11
	Firewood	1st class 17*s*.	per 100 stacked cubic feet.
		2nd class 14*s*.	

The Rohrbrunn Range contains 13,096 acres State and 2,965 acres communal forest, total area 16,061 acres. It is divided into two subranges, one in charge of an Assessor, the other directly under the Forstmeister. The latter, consisting entirely of State forest, includes six beats, the former five beats, three of which comprise only communal forest. The State forest area is thus composed—

More or less pure oak in one block (Geyersberg)	1,977 acres.
Mixed oak and beech	2,471 „
Beech with scattered oak and here and there conifers.	8,648 „

The annual yield of the State forests comprises—

Final yield	Oak	225,912 c. ft.	898,243 c. ft.	=68·6 c. ft. per acre.
	Beech	674,331 „		
Intermediate yield			272,195 „	=24°/o of total yield.
	Total		1,170,438 „	=89·4 c. ft. per acre.

The small percentage of the intermediate yield is explained by the large proportion of young stock. The Revenue and Expenditure of the State Forests, are, in round numbers, respectively, £15,000 and £4,000, the net revenue being thus £11,000 or very nearly 17 shillings an acre. The expenditure is thus distributed :—

	£
On timber operations	2,500
„ roads and communications	700
„ cultural operations	250
„ salaries, etc.	550

The Spessart is extremely well supplied with roads ; every part of every range can be visited in phaetons and barouches.

THE HAUPTSMOORWALD AND THE TREATMENT OF SCOTS' PINE FORESTS.

The Hauptsmoor forest was part of the territory assigned to the Prince Bishopric of Bamberg when that State of the old German Empire was established in A.D. 1007 by the Emperor Henry II and his wife Kunigunda, who was famous for her piety and model life. On the breaking up of the empire in 1803, the entire territory passed over to Bavaria.

The forest lies only half a mile east of Bamberg, a flourishing garrison town of 36,000 inhabitants. The area has varied considerably from time to time; it is now 8,823 acres, of which 7,663 are productive. The forest constitutes the East Bamberg Range of the Ueberfranken Conservatorship. The range is divided into four beats under one Forester and three Forstwärters respectively.

A ridge runs through the entire area from W. N. W. to E. S. E., the ground sloping gently W. S. W. and being more or less even and level on the other side of the ridge. The average elevation above the sea is about 1,050, the highest and lowest points being respectively 1,135 and 820 feet.

The greater part of the area (the western three-fifths) lies on the Keuper formation which yields a very poor, loose, dry sandy soil, except in the neighbourhood of the Lias, where it becomes slightly loamy. The eastern fifth of the forest overlies Lias marls and the soil there is a rich loam. The soil is everywhere deep. The soil over half the area degenerates into loose drifting sand, if not kept under wood.

The management of the forest has occupied careful attention for a long period. So early as 1784 Prince Bishop Franz Ludwig appointed a Commission of three forest officers to draw up a detailed working-plan. Amongst other measures, this Commission divided the forest into two working-circles, one of coppice, the other of high forest. The coppice was subjected to a rotation of 36 years, and a reserve of 21—24 standards per acre, to be selected from the coppice, was prescribed. The conifer trees situated within the coppice area were to be all removed with the exception of the larch. In the high forest area only conifers were to be grown, on a rotation of 110 years, but from 12 to 14 trees, each of a size to contain 83 cubic feet, were to be reserved at the final cutting. The yield of the high forest was fixed at 193,789 cubic feet annually. This working-plan, more than a century old, proves a very advanced condition of forest science.

The working-plan was not followed very long, owing no doubt to the disorder reigning during the Napoleonic wars. The irregular working during this disturbed period resulted, as a report made in 1810 shows, in a very disproportionate distribution of the age-classes. A new working-plan was now accordingly framed, which prescribed two different rotations of 120 and 90 years respectively for the high forest and an annual yield for it of 332,219 cubic feet. This plan was, however, very incomplete, and was not adapted to prevailing conditions.

Accordingly in 1820—22 a new working-plan was drawn up, which ordered only a single rotation of 120 years for the entire area and an annual yield of 402,919 cubic feet; but the quantity actually cut out in the decade 1831—1840 averaged annually 417,377 cubic feet.

At last in 1843-44 a new working-plan was prepared, which is still in force and has undergone three revisions, *viz.*, in 1855-56, 1867-68, and 1880 respectively. It is in essential points but little different from that of 1820—22, the application of which had yielded satisfactory results.

The forest is burdened with the following rights: (1) It has to supply one tree a year to be divided between four rightholders; (2) it has to furnish annually 24,745 cubic feet of ground litter of dead leaves; (3) the cattle of four communes, in all about 1,500 head, may graze free; (4) up to 1,414 cubic feet of clay may be dug out and removed.

The stock may be described in a few words. In all the western half, the soil being nearly pure sand, it is almost pure Scots' pine. As we advance eastwards, clay comes in and its proportion gradually increases, and we accordingly find spruce enter and become more and more abundant, beech and a little oak being also seen here and there. Once we reach the Lias area, broad-leaved species become numerous. It is here that the old coppice working-circle was situated; under the present working-plan the area has unfortunately been planted up with conifers, larch having been put down in the best soils. In former times, broad-leaved trees were found everywhere, by themselves on the loams, in mixture with pine elsewhere. Owing to the proximity of the town and the absence of a proper system of working, the continuous raid on oak for timber and on beech for firewood left these species a chance of maintaining themselves only at the further end of the forest. The working-plans, even the first, which admitted a working-circle of coppice, have precipitated this result by prescribing the planting of pure pine wherever the soil was sandy, *i. e.*, nearly everywhere.

Wherever the soil has not been weakened by the removal of the litter of dead leaves covering it, the growth of the trees, though slow, is excellent. The conifers attain a height of nearly 140 feet with straight, clean, and cylindrical boles. The forest was famed for its pine masts which went to Holland and fetched as much as 50 shillings a cubic foot. Up to this day first class logs are called *Holländer*. The pine yields timber up to 80 per cent. of its total volume.

As regards a market, the local demand is far in excess of the supply the forest can yield. Every stick produced can be sold. The high and varied rates given in the statements which follow prove the extent and keenness of the demand. The prices are all expressed in so many pence per cubic foot solid, except when otherwise specially stated.

I.—Large Timber.

Species.	*Holländer Logs:*— Length 70·7 feet Middle diameter 19·7 inches. Class.				*Commercial Logs:*— Length 59·4 feet. Diameter in middle 15·4—18·3 inches. Class			Logs containing 1		¾		½		¼		Length 23 ft. — Class.		Class.		Curved pieces.	Work Timber.	
								Füder:— Length 23 feet and upwards. Diameter in middle— 13·4—15		11·4—13		9·4—11		6·3—9						Per stacked cubic foot.	Per stacked cubic foot.	
								Inches. Class.		Class.		Class.		Class.								
	I	II	III	IV	I	II	III	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	I	II	III	IV		I	II
Oak	17	13½	10	...	13½	10	8½	12	9	12	8½	10	6¾	8½	6	12	10	8½	...	4	10	8½
Maple	...	...	...	...	...	...	...	15½	13½	12	10	10	8½	6¾	5	17	13½	10	...	...	...	...
Beech, Ash, Elm	...	...	...	...	...	...	...	10	8¾	8½	6¾	6¾	5	5	4	10	8½	6¾	...	...	...	...
Birch, Alder	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3½	...	...	...	...	...	...	...
Soft broad-leaved woods	...	...	...	...	...	...	...	6¾	6	6	5	5	4	4	...	8½	6¼	6	...	..	...	...
Pine, Larch	15½	12	8½	6¾	10	8½	6¾	9	6¾	7½	5½	5¼	4½	4¾	4	9½	8	6¾	5	...	5	...
Spruce	7½	6	5	4	7½	6	5	7	6	6½	6½	5½	4½	4¾	3½	7½	6	5	...	...	...	..

II.—Small Timber.

Species.	Poles for making furniture.		Scaffolding poles.	Axle poles and shafts.	Poles for building huts, etc.	Poles for props.	Hop poles per 100.			Per 100.			Stakes and Withies (Hoopwood) per 100.			Fascines 6½ feet long per hundred bundles.	Christmas trees and stems for decorative purposes per 100.					
	Class						Class			Class			Class									
	I	II					I	II	III	I	II	III	I	II	III		I	II	III	IV	V	VI
	Middle diameter in 10ths of an inch.																Length in feet up to					
	59	51	47	43	35-40	26-31	24	20	16	28	20	8	12	8	4	12	16½	16½	13	10	6½	3
	Contents in cubic feet.																					
	9	6	4½	2½	1¾	¾	71	57	28	71	35	7	5¼	4½	2¾	28 and upwards	43	28	14	5½	4½	1½
Broad-leaved woods { Hard	...	¾	½	¾	½	½	...	...	...	12½	6¾	4	3½	2	1	4½	...	...	...	...	...	...
Broad-leaved woods { Soft	...	½	¾	½	¾	½	...	...	...	10	5½	4	...	...	...	...	...	...	...	...	...	...
Pine, Larch . . .	1	¾	½	½	½	1/16	5	4	3	...	...	...	2	1½	¾	...	...	...	...	...	...	...
Spruce	...	...	...	...	...	...	7½	6¾	4½	6¼	5¼	3½	3¼	2½	1½	...	7½	6	5	3¾	2¾	1¾
Spruce	If cut at purchaser's expense.																6¾	5½	4½	3½	2½	1¼

III.—Firewood.

SPECIES.	Splitwood.			Round billets from stem.		Branch wood.		Unsound wood.		Root stocks.		Faggots per 100		Brushwood in heaps=100 faggots.				
	a	b	c	a	b			a	b	a	b	a	b	a	b	Green branches for decorative purposes.		
																Ready cut.	To be cut at purchaser's cost.	
	Per 100 stacked cubic feet.																	
Beech, maple, ash . . .	407	338	259	259	...	204	204	204	136	136	102	611	407	407	204	...	...	...
Oak, elm	407	338	238	204	...	136	136	204	136	136	102	407	259	306	170	...	...	...
Alder, birch	373	306	259	238	...	...	136	170	136	136	102	407	259	259	004	...	...	...
Broad-leaved softwoods . .	259	204	170	136	...	...	...	136	102	102	68	204	136	204	136	...	...	...
Pine	407	306	248	204	136	...	...	170	136	136	103	407	259	238	136	...	...	85
Spruce, Larch	373	306	221	170	136	...	...	170	136	102	68	338	204	259	136	259	238	

Under the present working-plan two rotations have been adopted, one of 96 years for the less fertile area containing deep loose sand (the western third of the forest), the other of 120 years for the rest of the forest. In both rotations the length of a period is 24 years, so that there are four periods in one and five in the other. The periods are divided each into two equal sub-periods. Whatever the rotation, promising trees are reserved at the final felling to attain large dimensions. Originally these trees were reserved wherever they were found in the coupe under exploitation, but as there is now practically no demand for thick logs and the best prices are obtained for pieces about 5 feet in girth in the middle of their length, there is no longer any object in keeping the reserves through the whole of a second rotation. They have, therefore, to be felled during the course of that rotation; hence the only way to obviate damage to standing stock from their felling and extraction is to reserve them in groups—a plan that is now being followed.

The annual yield is fixed as follows :—

The final yield . .	340,243 cubic feet	} =393,787 c. ft.
„ intermediate yield .	53,544 „ „	

It will be noticed that the intermediate yield is only 16 per cent. of the total yield. This is due to the absence of an auxiliary, shade-enduring species in the midst of such a light-demanding species as the pine. In the pure pine crops the dominated trees have to be spared as long as possible and from their very nature make but little growth. And obviously in the absence of the auxiliary in question, the forest cannot be kept so full and productive below the crowns of the dominant pines.

The productive area being 7,663 acres, the yield per acre per annum is only 51·4 cubic feet. But the final yield is a little above that of the 2nd class of the usual yield tables, an excellent result considering the nature of the soil. Here it will be interesting to give the results of an analysis, made by Dr. Baumann of the Munich University, of the two predominating soils—

	The red alluvial sand.	The white sand.
Silica . . .	96·25 per cent. . .	95·75 per cent.
Clay . . .	2·38 „ . .	3·06 „
Oxide of iron . .	0·53 „ . .	0·189
Phosphoric acid .	0·0114 „ . .	0·0077
Manganese oxide .	0·042 „ . .	Mere trace.
Calcium oxide .	0·123 „ . .	0·201 per cent.
Magnesia . .	0·055 „ . .	0·050 „

The extreme poverty of these soils leads Dr. Baumann to attribute the excellent growth of the pine to the underlying Keuper clay.

The regeneration is effected artificially after a clear felling, which is usually executed in bands the width of which is equal roughly speaking to the height of the grown-up forest (50 metres = 164 feet). The root stocks are at once grubbed out, the soil harrowed and pine seed sown broadcast at the rate of 8½℔ to an acre. The seed costs, according to the season, from 15 to 34*d.* a lb, and the cultivation and sowing of the ground from 39 to 49*d.* per acre, so that an acre sown costs from 14 to 28 shillings. But this is only when the soil is fairly clean: if it is overrun with grass and bilberry bushes, harrowing being impossible, it is hoed. The hoeing comes to 91 shillings an acre.

Where the sowing has failed, yearling plants must be put down at once. These are brought from Holstein and cost delivered in the forest 2 shillings a thousand. They cannot be raised locally on account of the *Schütte* pest.* The seedlings are planted out about 20 inches apart in lines about 40 inches apart, *i.e.*, 8,000 to the acre. The putting down of the plants costs from 3 to 5 shillings per 1,000, so that the outlay on planting up an acre varies from 40 to 56 shillings. The best results are obtained from planting on ridges, but the formation of the ridges adds 40 shillings an acre to the expenditure. The pine is never regenerated naturally, as attempts to do so have not proved successful.

Owing to the high value of spruce as a timber tree, 2-3 year old seedlings of this species are often interplanted with the pine, especially in the very sandy parts. The species also sows itself freely, from a few seed-bearers, as an undercrop, which is extremely useful for the protection of the soil. Where beech seed-bearers still exist, beech also introduces itself in abundance with the happiest results. Indeed, since the recent widespread insect ravages, which have destroyed and are still destroying thousands of acres of pure conifer forests, everything is being done to extend the area of beech. At present experiments are being made to ascertain the best and cheapest method of underplanting the species all over the forest. Once introduced, it will perpetuate itself without any difficulty by means of self-sown seed, and its presence will, I feel sure, enable the management to abandon the present costly and troublesome sowing and planting operations and regenerate pine naturally.†

Thanks to the agency of birds, oak seedlings are found, few and far between it is true, but in every part of the pine area. Thus in time, where now we have only pure pine, there will be constituted a magnificent forest of mixed oak, pine and beech.

On the best soils larch is largely planted. There it attains very large dimensions; but it succeeds only if it is given a start over the species with which it is mixed.

Its growth is very rapid in its early years; hence if during this stage its crown is not quite free, it hopelessly succumbs. Given the start, it is able to maintain it always.

Thinnings are begun at the age of 30—40 years and are repeated every 10 years or so. Owing to the character of the soil they are made moderate and even light. With well-conducted thinnings and proper care of the scattered individuals and small groups of broad-leaved species that make their appearance everywhere under the pine, the forest will before long become a good mixed one without much resort to expensive artificial means for introducing the required mixture.

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* For an account of this pest or disease see Fisher's Forest Protection.

† In the eastern half of the forest stands a large plot of mixed pine and beech, this latter forming a nearly complete understory. This plot should be constantly kept in mind as a model to copy in other parts of the forest.

The annual revenue and expenditure are, in round numbers, £10,700 and £2,540 respectively, the net revenue being £8,160 or £1·3s. per acre of the productive area per annum. The expenditure is thus distributed—

	£
Timber operations	860
Roads and communications	250
Cultural operations	310
Salaries, etc.	1,110
Regulation of hunting	10

The revenue from game is £60 a year, not a large figure, but obviously there is very little game to be found in the immediate neighbourhood of a comparatively large town.

Measures against insect ravages cost about £50 a year.

THE SIEGSDORF FOREST AND THE GROUP SYSTEM OF NATURAL REGENERATION BY SEED.

This is a system entirely unknown in France and therefore also to my colleagues in India who have received their professional education at Nancy, and have not since visited the forests of Bavaria. In my Manual of Sylviculture for India I have described the system only in general terms. I therefore offer no apology for entering into it in much more detail here by describing how it has been applied during the past 10 years in the State forest of Siegsdorf.* In the following notes I have freely used Dr. Karl Kast's excellent pamphlet entitled "*Die horst und gruppenweise Verjüngung im Königlichen bayerischen Forstamte Siegsdorf.*"

This forest is situated in the outer Alps between an elevation of 1,970 and 3,940 feet. It lies entirely on slopes drained by the torrent of the Red Traun, and occupies 4,448 acres. The annual yield amounts to, in round numbers, 300,000 cubic feet, or nearly 70 cubic feet per acre.

The hills are formed of tertiary rocks, to which their rounded contours and easy slopes are due. Near the bottom of the slopes, these rocks are overlaid with quaternary rocks composed of the detritus of the tertiaries. All these rocks are easily disintegrated, the result being a great diversity of configuration and numerous more or less deeply-cut water channels. The soil is generally deep, contains a large proportion of lime and clay and is hardly ever wanting in moisture, which is in some places so abundant as to render the ground almost swampy. Owing to its fertility, the soil is exposed to be overrun with heavy weeds in open places. Nevertheless there are not wanting parts where the soil is dry, shallow and stony enough to render regeneration difficult.

The climate is, even for the Alps, a severe one. The snowfall is so heavy and lasts so long that felling in winter is rendered impossible. A short spring is quickly followed by stormy, rainy summer weather and the autumn is clear and cold. Owing to the late vegetation spring frosts rarely do damage, and then only in the valleys and other low situations. Snow-breaks are also not frequent. The climate is specially suited for conifers—spruce, silver fir, larch—which all three make splendid growth here.

The most widely spread tree is the spruce, which is quite pure at the higher levels, and is mixed with silver fir on the middle and lower slopes, on which also strongly-branched beech, often completely overtopped by the spruce and silver fir, are met with either singly or in bouquets of two or three individuals. The proportion of larch also is slight. In the very wet places the white alder takes possession of the ground, and under it spruce seedlings readily establish themselves. At the lower levels, where the soil is deep and moist, mixed maple and oak are met with. It is probable that beech was originally much more abundant, but has almost disappeared owing to two powerful causes, *viz*.(1) The introduction of grazing animals in early spring, when its tender green leaves are greedily devoured, and (2), the former systems of regeneration, especially that by clear fellings, which did not give the species sufficient time to sow itself in adequate abundance.

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* The group system is of very wide application in Bavaria. It can be studied even within a few miles of Munich.

The principal hindrance to every kind of reproduction, whether artificial or natural, is certainly the grazing rights enjoyed by the villagers. No class of animal is excluded, and actually the following are driven in and allowed to wander about where they please, it being a condition that the right-holders need not send them out in charge of a herdsman : 40 horses, 252 horned cattle and 278 sheep. It is evident that the parts most frequented by the animals are the open places where reproduction is just beginning, and blanks which it is necessary to stock. There is no way of stopping this right, as its exercise is essential to the existence of the village.

The impossibility of felling in winter is also another serious obstacle to reproduction, since the young plants are most liable to damage while they are tender and full of sap in spring and summer.

In order to appreciate the advantages of the group method, the previous treatment of the forest and its consequences must be understood.

Many years ago the regeneration was effected in successive narrow parallel bands running up and down the slopes. The bands were clear-felled, with the exception of the smallest poles which were left as nurses and the trees on the edges sowed the ground. The two principal drawbacks of this method were that the exposed bands were at once overrun with grass and other fodder-yielding herbaceous growth, which brought the grazing animals on to them, and that the other species of the original mixed forest stood no chance against the freely germinating, rapid-growing spruce, which therefore almost exclusively composed the new crop. The numerous blanks and incomplete patches of reproduction had thus to be filled up artificially. This was done either by sowing or putting down transplants next to stumps and large stones so that they might escape the cattle. In any case the operation was slow and much time was lost.

The parallel band system was then replaced by that of successive regeneration fellings (preparatory felling, seed felling, and after-felling), but with no better result. A necessary condition of the system is to constitute the nurse and parent crop with trees as old as the rotation and, therefore, of considerable age and size, the consequence being that the soil, incompletely sheltered, soon covered itself with grass and other herbaceous growth which brought in the wandering grazing animals. Moreover, the felling and removal of the immense mass of the parent crop destroyed or badly damaged a great part of the new crop. The result here then was also incomplete, badly-developed young growth composed mainly of spruce requiring much expenditure of time and money to fill up and improve.

The only way to prevent the forest from degenerating into a pure one of spruce was to give the silver fir and beech a start. Neither of the two systems tried could do this; hence the adoption of the present one of effecting the regeneration, still under cover as in the method of successive fellings, but without attempting to obtain it all at once uniformly over every part of the area to be regenerated.

Under the present system the following programme has been adopted:—(1) To reconstitute exclusively by the group method the crops on the middle slopes and down to the lowest levels as mixed forest composed principally of spruce, but with a strong admixture of silver fir and beech, both of which species can by this method be given the necessary start over the spruce in the regeneration; (2) To continue to grow pure spruce on the upper slopes, but to regenerate it by means of groups all lying within one and the same band, so that when these have been extended and amalgamated, the whole band may be felled to complete the regeneration; (3) To maintain on the ridges a constantly intact forest subjected to the most restricted jardinage.

How this general plan is carried out will now be explained.

A.—Regeneration of the Mixed Forest.

It is advisable some years before beginning regeneration to cut separation lines (in German *Loshiebe*) through the area to be taken in hand, these cuttings extending over a width of only 33 to 49 feet. Their object is to render the separated crops storm-proof; but they also offer two other advantages in that they give the management an easy way of supplementing the annual yield when strong cultural reasons make heavy fellings in parts already under regeneration inadvisable, and they prepare the separated crops for the ensuing regeneration by admitting side-light, which helps to bring the soil into a proper condition for being sown and even introduces some advance growth. The separation lines are soon covered with a new regeneration which later on affords lateral shelter to the young crops for the creation of which they are cut.

The first thing to do is to decide which of the already existing groups, if any, are fit to form part of the new generation; next to create new groups at other points; and, lastly, to operate so that the groups of one and the other set may extend themselves in every direction, ultimately amalgamating to form the complete new generation required.

1.—Selection and first treatment of existing groups.

It is a fact well known to every forester that only those groups are fit to be utilized which cover at least several square yards and form a complete thicket, and which are moreover not yet too old to have lost the power of regaining complete vitality and shooting up with the fullest vigour on being uncovered. In this case the groups must, in addition, be composed of individuals that are not so old and large as to be unable to become amalgamated with the rest of the future crop, *i.e.*, with seedlings which have only just made their appearance or have still to make their appearance. The first two of the preceding conditions are essential because a mere patch of seedlings of some age, which do not touch one another, has no future at all before it, whatever care be taken of it; while the last-mentioned condition is necessary because here, although the cuttings partake more or less of the character of jardinage fellings, still the object is to obtain in the sequel a homogeneous crop containing only a single age-class, and not one enclosing tall groups standing out conspicuously above and dominating the rest of the crop.

If the groups to be utilized consist of silver fir, so much the better, since it is this, the slower-growing of the two firs, which requires to be brought on the ground first.

The selected groups will generally be found to be in immediate want of more light. To afford them this it suffices to remove 1-2 of the largest trees, more often only one, from over them. To open the leaf-canopy out too much would be as bad as, and even worse than, not opening it out at all, for, in the first place, the growth of grass and weeds, undesirable enough in themselves and a direct invitation to grazing animals to enter, must at all cost be prevented, and, in the next place, the groups must not be allowed to push up too rapidly for the regeneration of the rest of the area.

All the remaining groups, although not intended to form part of the future crop, are nevertheless preserved until the old crop is finally cleared. Everywhere they help to protect the soil and to provoke the appearance and establishment of new seedlings under their fostering shelter, while on steep or high slopes and in other unpropitious places they are always a reserve in hand against the contingency of new seedlings failing to make their appearance. Such groups, if too dense to give new seedlings a chance of coming up in their midst, are thinned out; otherwise they are left severely alone.

2.—*Creation of new groups.*

This is effected by means of special fellings made with the object of admitting more light and warmth on the ground at favourable points, which are plainly indicated by nature herself.

Obviously the silver fir claims first attention. It is seldom that under even a more or less complete canopy young seedlings of this species are not found in smaller or larger scattered patches. These are the spots over which the leaf-canopy requires to be opened out. Such patches appear where the soil contains the necessary quantity of moisture or is even inclined to get rather too wet, above all on slight eminences where the element of moisture is not wanting, under small openings in the leaf-canopy through which sufficient light and warmth have penetrated and provoked the appearance of some low vegetation on the ground, there, in short, where the conditions essential for germination and the maintenance of the resulting young plants exist. It is over such points then that the forest is opened out for the young silver to thrive, but not to such an extent as to enable the quicker-growing spruce to introduce itself or to produce a strong growth of grass and weeds. The outside limit of the area felled over at each point is, according to circumstances, 120—240 square yards, and the removal of 1—3 trees meets all requirements. The trees got rid of are always the largest and oldest; doing most damage by their fall. logging and extraction; such trees are got out of the way as quickly as the circumstances of the regeneration allow and before a complete new growth covers the ground. The circumstances referred to above as determining the area of the felling at any point are dangerous winds, invasion by grass and weeds, aspect, height of the leaf-canopy, etc. As regards its shape the felling is made longer than broad, on a hillside its length lying in the direction of the slope. The number of these little fellings is indeterminable; they may be located at intervals of 70, 200 and even more feet from each other, and if it is desired to ultimately form a large group, two or three cuttings are made close together. The question of facility in extracting the produce may also influence the number and distribution of the fellings.

After the silver fir the next degree of care is given to the reproduction of beech, the great sylvicultural value of which the Germans have only recently recognised. The few existing trees of this species are met with singly or in small scattered groups, and generally in the understory. Hence the only way to produce a crop of mast is to clear the leaf-canopy overhead, a procedure that yielded the happiest results in 1886 and 1888, when everywhere in the regeneration areas a sufficient quantity of beech seedlings was produced, which have been maintained and conserved in due proportion. Beech trees that are low-crowned are pruned.

Lastly, while the fate of the silver fir and beech is being assured by the special operations just described, the spruce is not entirely neglected; for if a good seed-year occurs in the meanwhile, fellings are made in the interests of this species in the intervals occupied by the groups constituted by its two companions. On account of the larger demand for light made by spruce, the maximum area felled over at each point may be as much as 360 square yards.

At this stage of the regeneration those uninitiated in the system of group fellings would see nothing in the crop to distinguish it from any other in which no such work as herein described had been done. There is no mature crop in which we do not find some small openings in the leaf-canopy, under some or all of which there is not a little young growth, and in the group-felled crop the little fellings are so scattered and removed so little from any one point that only an expert would recognise that they had been made.*

When the area of the crop to be regenerated is too large to be conveniently and easily handled, it is divided into smaller units, full advantage being taken of all natural division lines, such as spurs, water-channels, etc. In this case, as many group fellings as a consideration of other circumstances will allow, are located on or in the vicinity of these lines.

A group felling is never located on the edge of the crop to be regenerated, except where there is already a utilisable group of advance growth or at least a fair patch of young seedlings. Usually a fringe is left round the area in order to keep out side-light, which would encourage the growth of grass. Such a fringe is absolutely necessary on the north and east as a shelter against the dry cold winds that blow from those quarters, and generally on the side of all violent winds.

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* It is in this characteristic of the group system that its pre-eminent superiority over other systems, in which the age-classes stand on separate areas, lies. While never failing to regenerate, it keeps the forest just as safe against accidents as jardinage.

3.—Completion of the regeneration.

The effects of the operations described in the two preceding sections last only about two years. As soon as the silver fir and the beech in the groups are sufficiently advanced to have nothing more to fear from the entry of spruce, the largest trees bordering the groups are removed by felling them *away* from the group, which they would otherwise injure. This further opening out of the leaf canopy, while it is beneficial to the silver fir and beech seedlings below, also favours the introduction of the spruce; it is thus at one and the same time an after-felling for the first two species, a seed-felling for the spruce, and a preparatory felling for the zone immediately outside that in which this last is to sow itself. The groups are not entirely uncovered by these fellings, for the smaller trees and large poles of the old crop are still left standing in their midst so as to shelter them without exercising any of the injurious effects of cover.

The spruce seedlings that now spring up require themselves more light immediately they are two years old, for experience has shown that until they have begun to develop side branches (about their fourth year) they disappear unless they are in the full enjoyment of light. It is only after this epoch that they become so remarkably shade-enduring. This time again it is the largest trees bordering the groups that are got rid of. At the same time groups of spruce that may have chanced to come up where no fellings have yet been made, are cleared over, due care being taken not to give dangerous winds an entrance.

The subsequent operations consist:—

(1) In similar removals of the largest bordering trees at intervals of every 2-5 years, the length of the intervals being regulated chiefly by the requirements of the silver fir and beech. As the result of these repeated fellings the extending groups assume various, always irregular shapes, a few taking the form of a wedge, others that of a circle, the majority of an oval, ellipse or parallelogram, the longest dimension lying in the direction of the fall of the ground; and

(2) In the multiplication of fellings, especially in good silver fir seed-years, in the intervals between existing groups, with the object of ultimately connecting them together to form a continuous young crop extending over the whole area that was to be regenerated.

When this ultimate connection takes place, the young crop is still surmounted by the nurse crop or small trees and large poles which were spared each time the neighbouring large trees were got rid of. These are felled, in one or more operations, as circumstances require, as soon as the young growth ceases to need shelter. Their removal, thanks to their small size, is attended with no appreciable damage to the young crop. With them are taken out also the individuals that composed the unutilised groups existing when the regeneration was taken in hand.

The new crop thus produced accordingly consists of smaller or larger groups of more or less pure silver fir and beech scattered in the midst of a younger and therefore lower mass of more or less pure spruce, the tops of the crowns forming an undulating surface, the inequalities of which however disappear as the crop grows up. The mixture exists under the best possible conditions, each of the companion species occupying the soil and situation best suited to it and having an extension and distribution ensuring to it its just proportion at all future stages of the crop.

B.—REGENERATION OF THE MORE OR LESS PURE FOREST.

Such forest may be either (*i*) one in which the silver fir is represented only here and there in sheltered spots, or (*ii*) one occupying a generally sheltered locality and therefore containing scattered silver fir everywhere. Whichever class it is, the regeneration of the crop, in view of the extreme liability of the spruce to be blown down by winds, is effected in narrow parallel bands taken up successively, but within each band the group procedure is strictly followed. Such extreme localisation of the work necessarily renders the process a slow one, and hence when the crop is at all an extensive one, two or more series of bands are worked simultaneously, starting at opposite ends of the crop.

In the first class of forest, only a single band is taken up at a time and completed before the next one is put in hand. As in mixed forest, all patches of new seedlings and all utilisable groups of advance growth are extended, and the appearance of new patches is provoked in the intervals by means of little localised fellings, which admit just enough light for the young spruce, but not enough for a strong growth of grass and weeds.

In the other class of forest a bolder procedure is followed. Not only is the band actually under regeneration for spruce operated in, but more than one of the adjoining ones, whose turn has yet to come, are taken in hand with the double object of preparing the regeneration of the spruce, so that it may be carried through quickly once the turn of the band in question arrives, and (2) of securing, in the way described for mixed forest, the previous establishment of groups of silver fir and beech. This latter process is necessarily a slow one, as in most cases the silver fir and beech trees present have restricted or dominated crowns and require to be gradually prepared to bear seed.

It is hardly necessary to explain that the procedure here described has no analogy with that adopted in band regeneration by the system of successive fellings, for whereas in this latter system every felling operation is spread uniformly over the entire band and the new generation is the product of a single seed-year, here on the contrary the fellings are restricted to a few scattered points and two or more seed-years contribute to the complete sowing of the ground.

The procedure differs from that followed in mixed forest only in so far that the regeneration is confined within the narrow limits of a band or a few bands, within which narrow limits however it is pushed on quickly, since there is no reason to wait for previous silver fir and beech reproduction, for, if those species are present, such reproduction will be already on the ground, thanks to the preliminary operations effected as described at the end of the one but preceding paragraph above.

The bands are either (*a*) run horizontally or almost horizontally, succeeding one another from the top of the hillside downwards, as on southerly and westerly aspects, or (*b*) up and down hill, as on northerly and easterly aspects, in which case they follow one another on the ground, so far as that is practicable, in the direction contrary to that of dangerous winds.

C.—Length of time required for regeneration.

This period varies from 15 to 25 and even 30 years, according to the extent of the crop to be regenerated, the elevation of the locality, the rapidity of the growth, etc. What tends to prolong it is not so much the fear of frost as the damage of rank growth of grass and weeds, which, besides being directly harmful, are a standing invitation to grazing animals to enter. In mixed crops delay is further caused by the necessity of giving a good start ahead to one or more of the component species before the rest are allowed to reproduce themselves freely. But if, on the other hand, the work over the individual band in a pure or nearly pure crop proceeds more rapidly, on the other hand, owing to their narrow width, called for as an essential precaution against windfalls, the regeneration takes some time to go over the whole area.

In any case the time required is never longer than what would be necessary in any other system of natural regeneration by seed where the age-classes are kept apart in separate crops.

D.—Some remarks on group fellings in general.

In spite of felling being possible in the Siegsdorf forest only in summer, and notwithstanding the hilly ground, we nowhere see in it young growth damaged by the felling and export operations. This is due not only to the care and skill of all concerned*, but is inherent in the system and is a consequence of the triple fact that all the old and largest stems are taken out first and without being allowed to fall across the groups of young growth, that there is never a mass of produce felled at any one point, and that as the groups extend themselves over the area to be regenerated, not only the size of the trees still remaining to be cut, but also their number constantly diminishes, so that when the new crop is complete, there are left only scattered small trees with restricted crowns and large poles to be removed. In no other system of natural regeneration by seed under cover is there so little damage done by the new crop, and the results obtained in Siegsdorf furnish a complete refutation to the charge made everywhere in Germany against such natural regeneration by seed in general, *viz.*, that the expense of repairing the injuries suffered by the young crop from the felling and export operations exceeds what a complete artificial restocking of the area from the very beginning would have cost. In Siegsdorf the amount of artificial aid to reproduction required is practically *nil*.

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* As a special precaution no more trees are allowed to be felled on any day than can be cut up and removed to the roadside either the same or, at the latest, the very next day.

Siegsdorf furnishes a complete answer also to another charge, a serious one, directed specially against the group method. It is maintained that the cost of felling and extraction necessitated by this method is in excess of that in every other method of regeneration, whether under cover or after a clear felling. How unfounded this charge is, is evident from the fact that whereas formerly, when clear fellings were made, the charges on a cubic foot of wood brought to depôt averaged 0·81*d.*, they now fluctuate, with the distance of transport, between 0·42 and 0·85*d.*, the average being markedly lower than 0·81*d.*

E.—THINNINGS.

Owing to the difficulty of transport and the low market value of the produce thinnings are not begun until the age of 60—70 years, and are repeated only at comparatively long intervals. They are hence made more or less severe.

The three essential objects of thinnings in general are, as every forester knows, realisation of dead and sickly individuals, favouring of the growth of the trees which have their crowns in the highest part of the leaf-canopy (the trees of the future) and securing a proper mixture of species at every age of the crop. Here, in the special case of crops to be regenerated by the group method, a fourth object is added, *viz.*, the provision of a sufficient number of small, narrow-crowned and large poles to form the nurse crop during the regeneration. Hence at each thinning a certain number of evenly distributed overtopped and dominated individuals that are still healthy and possess fairly good crowns are preserved. The more silver fir among the stems thus spared, the better; and, indeed, in mixed forest it is the pre-eminently shade-enduring silver fir that would naturally furnish the greater number of such stems. Accordingly, only the following are removed by the thinnings:—

(1) All completely suppressed individuals.

(2) All canker-stricken silver fir without exception.

(3) All those individuals, which, although they belong to the upper stratum of the leaf-canopy, possess only thin exiguous crowns or are soon bound to be reduced to this condition, or are badly misshapen or otherwise hopelessly deformed.

F.—CONCLUDING REMARKS ON THE GROUP SYSTEM.

The Siegsdorf forest shows the great superiority of the present system over its predecessors. Under them a mixed forest had become almost pure in spite of every effort to maintain the mixture, large recourse to artificial restocking used to be necessary, and windfalls were numerous. Since the adoption of the group method the mixture of beech and silver fir with the spruce is being rapidly restored by natural means alone; artificial aids to regeneration have become practically unnecessary in spite of the severe climate, the hilly ground and the uncontrolled grazing of horses, horned cattle and sheep; windfalls have become exceptional in spite of frequent hurricanes which ravage neighbouring forests under other systems of treatment; and the cost of timber operations, notwithstanding the more detailed nature of the present treatment, has been diminished. As a protective treatment the system has proved itself as safe as the strictest jardinage.

And indeed the system is really a jardinage without the mixture of age-classes. Like jardinage, it never leaves the soil bare and it secures regeneration not in one continuous mass, but by patches; and also, like jardinage, the operations it prescribes are distributed over a wide area of the forest. In Siegsdorf there are at this moment as many as 40 crops, composing more than one-twentieth of the area, under the group fellings This spreading of the operations has been proved, contrary to the anticipations of the advocates of clear-fellings and of successive fellings for regeneration under cover, to be no disadvantage, but even a very distinct advantage in the matter of damage by grazing and cost of timber operations, both of which have been diminished since the adoption of the group method.

It may be urged that the method is successful in Siegsdorf because the climate there is moist and moisture in the soil never fails at the required moment, and that it will not answer in dry localities. The argument stated thus really cuts the other way. The group method differs in no essential respect from a regulated jardinage, and it is an axiom with all foresters that jardinage is successful as a regenerating method in all extreme conditions of soil and climate; and coming back to the special case of Siegsdorf, the retort is obvious that the other methods favoured by the detractors of the group system, were tried, but failed completely even in spite of the moisture conditions being propitious.

II.—FORESTRY IN SAXONY WITH SPECIAL REFERENCE TO THE SPRUCE FORESTS OF THE ERZGEBIRGE.

ALTHOUGH Saxony is a State from the forests of which the Indian forester can draw no directly useful lessons for his work, still, being the country of Cotta and Pressler, who have done more than any two other men together to advance the limits of forest science, it is well worth a visit. Saxon forestry has been reproached with striving too much after the ideal, with sacrificing sylvicultural to financial considerations; but it is only fair to believe that those who have contributed to make it what it is, possessed just as much acumen and foresight and grasp of principles as its opponents and that they have adapted their methods to the special circumstances of the country. And to come to facts, a system which produces annually per acre 85 cubic feet of wood (of which 81 per cent. stem wood and 65 per cent. timber) worth net nearly 17 shillings (2·9 times the Bavarian and 3·5 times the French figure!) and which gives an average return of 2·39 (maximum 4·43) per cent. on the capital value of the forests, cannot be charged with being unpractical, especially when we remember that it is now more than 60 years since every State forest of the country has been under the regime of detailed and elaborate working-plans.

A summary account of the forest resources and organization of the State will be interesting.

Saxony lies between parallels of North Latitude 30°21′ and 31°30 and meridians 11°45′ and 15° of East Longitude. It contains an area of 5,750 square miles, or less than twice that of an average Indian district, and a population of 3,503,000 souls. The subjoined table shows how the forests are distributed :—

NAME OF DISTRICT.	Area of District in acres.	TOTAL AREA UNDER FOREST.		COMPOSITION OF FOREST IN PERCENTAGE OF AREA.		STATE FORESTS.		
		Acreage.	Percentage of District area.	Broad-leaved species.	Conifers.	Acreage	Percentage of total forest area.	Percentage of total area of State.
Dresden . . .	1,066,227	280,195	26·3	10·5	89·5			
Leipzig . . .	870,339	112,984	13·0	36·4	63·6			
Zwickau . . .	1,184,261	396,159	34·9	4·7	95·3			
Bautzen . . .	609,399	168,740	27·7	13·2	86·8			
TOTAL .	3,680,226	958,078	26·0	11·6	88·4	430,315	44·9	11·7

As in Bavaria, the Forest Department forms part of the Ministry of Finances, the professional head being an officer designated *Oberlandförstmeister,* the equivalent of an Indian Conservator where there is only one such official in a whole province. Below him come successively *Oberforstmeisters* or Deputy Conservators (in charge of Divisions), *Oberforsters* or Senior Assistant Conservators (in charge of ranges), and *Assessors* or Junior Assistant Conservators (in charge usually of sub-ranges). The organization of the various charges is shown below.

DIVISIONS.			RANGES.				REMARKS.
Running number.	Name.	Acreage.	Number.	Average Acreage.	Number of officers attached.		
					Ober försters.	Assessors.	
1	Dresden . .	27,744	8	3,468	7	3	* The head-quarters of the Working-Plans Division, which operates wherever there is work to be done, are fixed at Dresden.
2	Moritzburg . .	32,644	7	4,663	7	1	
3	Schandau . .	50,754	13	3,904	13	5	
4	Grüllenburg . .	26,272	9	2,919	9	2	
5	Bärenfels . .	35,659	8	4,457	8	3	
6	Marienberg . .	44,950	10	4,495	10	1	
7	Schwarzenberg .	47,421	12	3,943	12	2	*N. B.*—As in Bavaria, ranges and sub-ranges are divided into beats in charge of subordinates of all classes and grades.
8	Eibenstock . .	44,216	10	4,422	10	3	
9	Auerbach . .	55,936	13	4,303	13	4	
10	Zschopau . .	27,750	8	3,469	8	5	
11	Grimma . .	36,969	10	3,697	9	6	
12	Working-Plans* .	...	...	...	...	12	
	TOTALS .	430,315	108	3,984	106	35	

The distinguishing characteristic of Saxon forestry is the minuteness of detail with which every measure of treatment is carried out. Hence they have not only small ranges, but small working-circles and small sub-divisions of the working-circle, the sub-divisions being of several successive degrees. This will be clear from the following. The successive sub-divisions of the working-circle are denoted thus: The first means of Roman numbers (I, II, III, . . .), the second by printed ca tals (A, B, C . . .), the third by means of printed capitals with an in number (A^1, A^2, A^3 . . .), the fourth by written capitals *A*, *B*, *C*, *D*, . . .); the fifth by Arabic numerals (1, 2, 3), and the sixth and last by means of small written letters, (*a*, *b*, *c* . . .), so that one of the lowest sub-divisions would be indicated thus—III B^3 *A* 4*c*, its area being anything from a few square poles to a few acres.

Up to about twelve years ago the soil and locality combined was divided into five quality-classes. Experience showed that the limits of each quality-class were incoveniently wide; accordingly the number was increased to 13 by means of intermediate divisions. The old numbers were expressed in descending order by the numerals I, II, III, IV and V; the new numbers are thus expressed, it being found advantageous to retain the old numerals in order to show their original limits—I, I/II, II/I, II, II/III, III/II, III, III/IV, IV/III, IV, IV/V, V/IV, V.

The stock is divided into five quality-classes as originally and as is done all over Germany.

One of the objects of these minute divisions of the area and of the quality-classes of soil and locality, on the one hand, and of the stock, on the other, is to facilitate the estimate of standing material by the eye alone, not only in the interests of the Working-Plans Branch, but also of the Executive Officer. It is astonishing to see how quickly and with what near approximation these estimates can be made, after a little practice, by any forest officer possessing no special gifts in this direction.

The great aim of the Working-Plans is to progressively and ultimately effect an exact distribution of the age-classes and to assign to each period of the rotation an area of equal productive power. Hence the minuteness with which the forest is divided up and studied at each 10-year revision of the Working-Plans. In order to maintain a spirit of continuity in prosecuting this object, a new stock map, depicting the distribution of the component species and the age and quality-classes, is prepared at each revision. Thus, for every forest there is a series of maps showing at a glance what it was at the successive 10-year intervals during the past 60—70 years. There is no other Forest Department in the world which can show such a triumph of industry and tenacity of purpose. The maps are on two scales, the larger one, for working purposes, being $\frac{1}{1213\cdot8}$ (=about 13 inches to 1 mile), the other= $\frac{1}{19418\cdot3}$ (= about 3 inches to 1 mile) being for quick reference. Their utility both for working-plan revisions and for executive work cannot be overestimated. For the Lauter Revier, the working-plan of which I studied in detail, there are 8 such maps, prepared respectively in 1827, 1839, 1849, 1859, 1869, 1873, 1883 and 1893. That the newest of them should, after 66 years of the gigantic progress which has completely revolutionized forest science, be constructed on the same principles as the oldest is a proof of the wonderful genius and intellect of Cotta.

In addition to the 10-year revision an intermediate revision at the end of the fifth year of the interval is made, which revision is, however, limited only to the portions prescribed for at the preceding revision. These frequent revisions and the detailed nature of the working-plans would induce the belief that the executive officers were reduced to the mere condition of machines for carrying out every detail of treatment. It is not, however, so in reality. Within the portions assigned to the period prescribed for and to each class of felling ordered these officers are completely free to lay out their coupes and plant or sow in any year where they judge best.

The encroachment of iron on the domain originally occupied by timber alone began to tell unfavourably on the prices of wood more than 80 years ago. The fall in prices and demand was most marked in the case of large timber. The Saxon Forest Department was quick, perhaps too quick, in adapting itself to the altered state of the market. They determined to reduce the rotation for their conifer forests to 80 years. As long ago as 1868, the relative areas occupied by crops 1—20, 21—40, 41—60, 61—80 and upwards of 80 years old were as 27 : 26 : 19 : 14 : 14; in other words, the two youngest age-classes occupied each a little more than 25 per cent. of the total area of the forests, while the two oldest classes together hardly covered more. Since then the last age-class (above 80 years) has been reduced by more than 55 per cent. The lowering of the age of exploitability to 80 years does not prove that in the little kingdom of Saxony no larger timber than what can be produced in 80 years is required, but its Forest Department is sagacious enough (and in this there is a large compound of selfishness) to understand that while it works its forest at a high rate of interest and returns a large net revenue per acre per annum, the adjoining States of Austria, Bavaria and Prussia will continue to supply the large timber required by the Saxon people.*

In the working of each forest the greatest weight possible is laid on establishing exploitation units which give a succession of coupes satisfying every cultural and economical requirement. These are the *Hiebszüge*. Once established, they make it extremely easy to choose and lay out the cuttings to be made in any given year or period, without having to run counter to the rules for the succession of coupes or to sacrifice a crop before it is quite exploitable or to keep another standing too long after it has become exploitable. In their establishment the main determining conditions are the direction of the dangerous winds, the configuration, gradient and aspect of the ground and the lines of export. Moreover, they must be of convenient size, neither too larg nor too small. It is thus evident that *hiebszüge* and the *Séries d'exploitation* of French foresters are in no sense one and the same thing. The former furnish a succession of fellings for only a limited and indeterminate number of years, the latter for nothing more or less than the entire duration of a rotation. Hence *hiebszüge* can neither be held as having any connection or relationship with the French *Affectations périodiques*. The *hiebszüge* are separated by permanent cleared lines, which may be regular roads, but are usually used only as temporary export lines, while the adjoining *hiebszüge* are under exploitation.

As the *hiebszüge* are not yet fully established owing to the forest being still abnormal, present crops are often required to be split up either with the object of separating two future *hiebszüge* or of effecting a more normal distribution of the age-classes. In the latter case it would be dangerous to begin felling without first opening the line of separation and allowing the border trees in the part not yet to be felled to strengthen themselves and take a stronger hold of the soil. The separating line, which is cut about 20 feet wide, is called a *loshieb.* If not required to be permanent, it restocks itself, having fulfilled its duty of enabling a succession of cuttings to be made in the adjoining part of the crop.

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* To a certain extent this resembles the conditions in which many Native States in India are placed. Being surrounded by conserved forests in British territory, they do not realise that their own forests are rapidly disappearing, and, even if they do, they trust to the British forests supplying the wants of their people, when their own resources are exhausted.

To resume what precedes, the Saxon system of managing high forests consists in forming small ranges, in adopting very short rotations and periods, in allotting to the several periods areas of equal productive power, in making every ten years a complete revision of the working-plan, followed at the end of the fifth year by a revision confined to the portions still remaining to be worked during the rest of the 10-year period and in establishing good *hiebszüge.* The frequent revision and the detailed study of each forest which its minute sub-division allows, have rendered possible the drawing up of yield tables based on 13 soil and 5 stock quality-classes, so that sufficiently correct estimates of standing material can be expeditiously and summarily made with the eye, thus making the otherwise longest and most troublesome part of the duties of the working-plans officer a comparatively light and trifling matter. I need scarcely add that the old exploded idea of trying to group the area allotted to each period of the rotation into a single continuous block and thus force nature into fetters which she cannot tolerate has no part in the system.

None of the working-plans are printed. In the Appendix are given the principal headings of a Working-Plan Report and a copy of each of the printed blank forms used therein. The "Prefatory Remarks" fill about 40 pages, and obviously the majority of them, since they describe permanent conditions, are copied without change from the old plans into the new one. The appendices are written up in printed forms. The real working-plan is Part III; it is here that the details of work prescribed, with justification and explanation, are given. The whole Report and Proposals are stoutly bound up and form a volume of 200—300 foolscap pages This sounds formidable, but all the control forms are amalgamated in the proposal forms, so that entries are made *pari passu* with the progress of work and the appearance of results. Blank pages are left for the 5-year revision. Thus each volume contains complete information (general description of the forest, proposals, work done, results obtained, etc.) for the 10-year period to which it refers, and 10 such volumes give a detailed and exhaustive history of the forest extending over a century.

I will now pass on to the spruce forests of the Erzgebirge, the broad range of mountains running east and west, the southern half of which lies in Bohemia, the northern in Saxony. The country is especially a forest one, consisting of densely wooded hills separated by richly cultivated valleys dotted everywhere with factories, at a great many of which wood pulp is made. The establishment of this latter industry, which uses up 25 per cent. of the yield of the forests, consisting for the most part of wood that without it would be sold as mere firewood, is of incalculable advantage to the forest management with its short rotations.

The lowest prices obtained for spruce wood are as under:—

Whole length stems.	12 inches and over in diameter in middle		. 7·1—7·5	*d.* per cubic foot.
	9-11½ in.	„ „ „ „ „ „	. 6·4	„ „ „ „
	7¾-8½	„ „ „ „ „ „ „	. 5·4	„ „ „ „
	6¼-7½	„ „ „ „ „ „ „	. 4·8	„ „ „ „
	5-6	„ „ „ „ „ „ „	. 4·0	„ „ „ „
Short pieces up to 11½ feet long.	12-15	„ „ „ „ „ „ „	. 8 1	„ „ „ „
	9-11½	„ „ „ „ „ „ „	. 7 8	„ „ „ „
	6¼-8½	„ „ „ „ „ „ „	. 5 1	„ „ „ „
	5-6	„ „ „ „ „ „ „	. 4·0	„ „ „ „
	3-4¾	„ „ „ „ „ „ „	. 3·7	„ „ „ „
Billets 40 inches long and from 3 to 6 inches middle diameter			17*s.*	per 100 stacked cubic feet.

It is the last two classes of short pieces and billets of good quality that go to the wood-pulp factories.

Spruce bark is sold for tanning purposes at 37 shillings a 100 cubic feet. The open grass meadows are leased at an average of 28 shillings an acre. The more boggy portions are utilised for the production of peat. The cost of preparing peat bricks 10″ × 3″ × 3″ is 17 pence per *mille*, which sells for 3 shillings, or 19 pence net.

The forests are situated between 1,100 and 3,970 feet above the sea, so that more than half the area is climatically suited for silver fir and beech, and the lower levels also for oak. But the principle of the largest net revenue per acre per annum and also of the highest rate of interest on the capital value of the forests, followed persistently during so many decades, has resulted in relegating those species to extremely narrow proportions. Broad-leaved species are, however, now being encouraged in certain places, especially where the smoke from the factory chimneys and the railway hangs heavy and causes conifers to sicken and even to die. In a slope not far from Schwarzenberg nearly every tree has been killed by the smoke nuisance. Oberforstmeister Täger tells me that the smoke of factories affects forests situated several miles distant. The smoke is especially injurious, as it is the local brown, highly sulphurous coal that is burnt both on the railway and in the factories.*

The rock in the region consists principally of schists and shales, with some intrusions of granite and smaller ones of basalt. The soil is accordingly very variable, but is generally excellent for spruce, as is proved by the following figures:—

A coupe 110 years old, on soil of II/III quality only, yielded clear felled 715 cubic feet per acre, which sold for £121, the annual yield per acre per annum, exclusive of *all* the intermediate produce, being 65 cubic feet in material and 22 shillings in money. The corresponding figures for two other areas were :—

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* The same kind of coal is burnt in the locomotives of the railway running through the valley in which Tharandt is situated. At Tharandt there is, I believe, only a single factory, and yet numerous conifers are in a dying condition on both sides of the railway for miles.

Soil quality II/III, felled at 80 years, yield per acre per annum, material 100 cubic feet, money 28*s*.

Soil quality I, felled at 75 years, yield per acre per annum, material 138 cubic feet, money 44*s*.

The ratio of the intermediate to the final yield is roughly as 3 : 7, proving how close the leaf-canopy is kept. At the age of 80 years as many as 600 stems may be found to the acre.

The magnificent results obtained, as shown by the preceding figures, certainly justify the system adopted by the management. The figures quoted on page 49 above make it clear that prices increase only very slightly above a middle diameter of 12 inches, and as a rotation of 80 years suffices to produce stems of this size, there is no financial reason for adopting a longer rotation. At present, however, as the forests have not yet been brought into the condition desired, there are still a certain number of crops of higher age which have to be cut, and the *hiebszüge* are still imperfect; accordingly to satisfy both these conditions the felling of 80-year and even older crops have often to be postponed and others not yet 80 years old to be cut. If I may be allowed to hazard an opinion, judging from the results obtained when the average felling age has always appreciably exceeded 80 years, a slight raising of the rotation will not only bring the management of the forests more into harmony with facts, but also, without at all lowering the annual yield, diminish the trouble and expense of sowing and planting by diminishing the area to be restocked each year. I feel certain that a rotation of 88 or 92 years will answer. If in some crops, where the growth was extra rapid, many of the trees attained the most paying diameter before the end of the rotation, there would be no difficulty in extracting these trees in the last or two last thinnings, leaving one or more of the adjoining smaller trees still in the full of vigour of growth to fill their place and reach in their turn exploitable size, which they could not otherwise attain. In this manner the number of trees of exploitable size as well as the annual yield would be appreciably increased, without at all lowering the rate of interest obtained on the capital value of the forests. I am afraid that it is this bugbear of the highest possible rate of interest which makes the working-plans direction lull itself into the belief, a certainly erroneous one, that their rotation is only one of 80 years. They have had more than 30 years, or nearly half the theoretical rotation, in which to get rid of the age-class above 80 years, and yet during this long period the residuary portion of this class remains practically what it was at the beginning of this period. To take the Lauter Range, one of their show places, for example, the percentage on the entire stock of this age-class was 9·6 in 1849, 9·5 in 1859, 7·9 in 1869, 7·7 in 1873, 7·8 (0·1 higher) in 1883, and 6·2 in 1893. During the last of these decades the enormous extension of the wood-pulp industry has enabled the management to act with increased boldness, but this does not prove that the principle of an 80-year rotation is right. If further warrant for what I have said is required, I have only to mention that in all the ranges I visited I never failed to find several crops not less than 80 years old which have not yet been cut because the trees are still generally undersized. As I have suggested above, it is only necessary to slightly modify the nature of the last, or of the last two thinnings, in order to sufficiently increase the yield to render it possible to raise the rotation without lowering the return per cent. on capital value.

It remains now to describe briefly the method of treatment. The clear fellings are effected as much as possible in bands of variable width which present their shortest dimension to the prevailing dangerous wind and succeed each other in the direction of the quarter from which the wind blows. In respect of the wind too many precautions cannot be taken for the shallow-rooted spruce. In 1868 the entire crop occupying about 37 acres on the brow of a hill was blown down. The usual direction of the strong winds is between East and West and N.-N. East to S. S.-West. If the coupes cannot be laid out running up and down the slope of the ground, they are made to follow contour lines and succeed each other from top downwards. In this latter case, owing to the variability of the configuration of the surface, the bands are not of uniform width : not unfrequently they have the form of a long acute-angled triangle.

Owing to the depredations of the pine weevil (*Hylobius Abietis*) grub, which at once swarms in the exposed soil on the roots and root-stocks of the felled trees and would make short work of any young growth that might be introduced before they had disappeared, the restocking of the cleared coupe is not undertaken for 2 or 3 years after the felling. Even then some grubs still remain in the soil to give very often considerable trouble. To get rid of them, thick fresh cut stakes are buried for most of their length obliquely in the ground at intervals, and are frequently visited and the grubs attracted by them caught and destroyed. This is also a means of testing whether the grubs have disappeared before beginning to restock. The grubbing up of the roots and root-stocks is the best way of keeping out the insects, at any rate of diminishing their numbers, but it is a measure possible only on fairly level ground.

The felled coupes are either sown or planted up with three-year old nursery-raised seedlings. The sowings are effected in furrows 4½ feet apart, two lines of seeds being sown in each furrow. The quantity of seed used is 9℔ per acre; but this quantity really gives more plants than is necessary, and some of the local officers are of opinion that 7℔ would be sufficient. In the case of planting, the seedlings are put down 4½ feet apart each way (square planting), thus necessitating about 2,400 seedlings an acre. In planted areas repairs are required to the extent of as much as 20 per cent. : next to none is necessary in the sowings, which also always form better crops. The cost of sowing per acre is, for the preparation of the ground 18 shillings, for purchase of seed 5 shillings; total 23 shillings. The corresponding figure for planting is 24 shillings for the original operation, plus 5 for repairs; total 29 shillings. If the planting costs 6 shillings more per acre, it saves three years of time—a circumstance which, where financial considerations are all important, cannot be altogether neglected.

The adjoining coupe is not felled until the young crop in the one last exploited is completely established and safe from all further risk, that is to say, until it is at least 5-6 years old. Hence the difference in age of the new crops on two successive clean-felled areas is never less than 8 years When all the *hiebszüge* have been normally established, this will be the constant difference.

The first thinning is usually made at the age of 25—30 years, but occasionally it is required as early as 15 years. Up to the sixtieth year, *i.e.*, during the phase of rapid upward growth, they are repeated every five years; thereafter they are effected at intervals of ten years. Even these later thinnings cannot be more than moderately severe, firstly, because of the heavy snowfall, next, because grass must not be allowed to put in an appearance anywhere, and lastly, in order to keep out the wind. The first thinning, which consists mainly in removing all the completely suppressed (not necessarily dead) stems is made by the woodcutters acting on their own discretion. In subsequent operations the selection of the stems to fall must be made by the range officer or the subordinate in charge of the beat.

For work in each range a regular gang of a fixed number of selected workmen is organised, who are paid by the piece according to fixed rates. Each man works on an average, in round numbers, 250 days in the year, earning a total of about 525 shillings or less than 2*s.* 2*d.* a day. In spite of the numerous factories, the population, being crowded, is very poor, although remarkably laborious.

The forests are everywhere furnished with a most perfect system of roads, which are metalled over a width of 10 feet and cost from £323 to £480 a mile.

In conclusion, I cannot help believing that the heavy expense and great risk of artificial regeneration could be avoided by adopting a suitable system of natural regeneration. In most respects the Erzgebirge region resembles closely that of the outer Alps in which Siegsdorf is situated,* and in point of climate it is decidedly more favourably circumstanced. If the group system of natural regeneration succeeds with such certainty at Siegsdorf, why should it not succeed equally well in the Erzgebirge? I was shown a few naturally regenerated crops which were of decidedly inferior quality compared with the surrounding artificially created forest. The natural regeneration had, however, been effected by the formerly over-vaunted method of successive uniform fellings, and it was clear from the strongly branched stems and a tendency to a squat habit that unsuitable advance growth had been utilised to form the new generation.

The adoption of the group system would, of course, require the raising of the rotation to at least 100 years; but as in that method the largest trees of the crop under regeneration, which would be commenced at about the age of 75 years, would be always cut out first, enabling the smaller, but not less vigorous, neighbouring stems to put on the full rate of diametral increment, and similar operations would be carried on simultaneously in several crops, the current rate of growth would be more than maintained throughout the 20—25 years of the regeneration period of every crop and the heavy expense of restocking and the constant struggles against the pine weevil avoided The present cost of sowing mounts up in 80 years, at only 2 per cent. compound interest, to 166 shillings, or an average of a little over 2*s*. per acre per annum. The smallness of the ranges is favourable to the adoption of the group method, requiring as it does more skill and constant close attention than the very simple system of clear fellings with subsequent artificial restocking. It is lucky that the insect devastations which have attained such enormous proportions since the last 30 years in the artificially created conifer forests of Germany have not yet reached the Erzgebirge; but who can tell how soon this happy immunity may not cease?

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* See Report on Forestry in Bavaria, pages 34 *et seq.*

APPENDIX.

Principal Headings of a Saxon Working Plan.

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Part I —PREFATORY REMARKS.

In these remarks the chief importance is laid on the classification of the soil and crop in order to devise correct yield tables and compare the possible (normal) yield with the actual yield. Hence no detail bearing on this subject is omitted and the progress of the forest from decade to decade is closely compared.

PART II.

APPENDICES.

BEILAGE A.

FLACHEN UND BESTANDS REGISTER

VOM

(Enthaltend den Befund beim Beginn des Forstjahres ______)

ABKÜRZUNGEN.

a. = alt
abw. = abwechselnd
ält. = älter
Ah. = Ahorn
Ak. = Akazie
Anfl. = Anflug
Apfb. = Apfelbaum
As. = Aspe

Bi. = Birke
Bl. = Blösse
Bu = Buche

dav. = davon
drgl. = dergleichen
dsgl. = deglesichen

Eb. = Eberesche
Ei. = Eiche
ei. = einige
eiz = einzelne
Erl. = Erle
Esch. = Esche

Fi. = Fichte
Flb. = Faulbaum

Ha. = Hasel
Hb. — Hornbaum
Hol. = Hollunder
Hst. = Horst
hstw. = horstweis

j. = jung
jahr. = jährig
jüng. = jünger

Kas'. = (Edel-) Kastanie
Kiefer = Kiefer
Krki. = Krummholzkiefer
Krschb = Kirschbaum

La. = Larche
Lb. = Laubholz
Lin. = Linde

m. = mit
Mitw. = Mittelwald

Na. = Nadelholz
Ndw. = Niederwald

Obh. = Oberholz
obst. = oberstandig

Pa. = Pappel
plw. = platzweis

Rd. = Rand
Rde. = Raumde
Rh. = Reihe
rhw. = reihenweis
Rkast. = Rosskastanie
Rü. = Rüster

Sch.-Erl = Schwarzerle
Schki. = Schwarzkiefer
Ski = Sumpfkiefer
Stcks. = Stockausschläge
Stl.-Ei. = Stieleiche
Stll. = Stelle
stllw. = stellenweis
Strf. = Streifen
strfw. = streifenweis

Ta. = Tanne
tls. = teils
tlw. = teilweis
Trb.-Ei. = Traubeneiche
Trp. = Trupp
trpw. = truppweis

u = und
Übh. = Überhalter
ubgh. = ubergehalten
Utb. = Unterbau
utb = unterbaut (untergebaut)
utdr. = unterdruckt
Uth. = Unterholz
utpfl. = unterpflanzt (untergepflanzt)
Uts. = Untersaat
uts. = untersat (untergesat)
utst. = unterstandig
Utw. = Unterwuchs
utw. = unterwüchsig

v. = von
Vjkl. = Verjüngungsklasse
Vorw. = Vorwuchs
vorw. = vorwüchsig

Wach. = Wachholder
Wchh. = Weichhölzer
Wei. = Weide
Wki. = Weymuthskiefer
Wss.-Erl. = Weisserle

Zki. = Zirbelkiefer
Zws. = Zwischenwuchs
zwsw. = zwischenwüchsig

Bezeichnung.	GRÖSSE.		BEMERKUNGEN.	Altersklasse.	Bonitätsklasse.
	ha	a			
			Thanks to the abbreviated technology given on the opposite page, the descriptions of the compartments are very brief; that of 99 out of 100 not extending beyond two lines. The largest division of a forest is the Section (=what comes on one sheet) and is denoted by Roman numerals I, II, III,...... Then each separate (standing by itself) block is denoted by printed capitals, and the first order of sub-divisions of blocks by means of index numbers over the Block letters: thus A^1, A , A^3. The further divisions are indicated by written capitals (*A*, *B*,...), Arabic numerals (1,2,3,...) and small written letters (*a*, *b*, *c*,...) in descending order. What is denoted by Arabic numerals is the equivalent of the "*parcelle*" of the Nancy School, the small written numerals thus signifying the same thing as the "*sousparcelle*," which may contain from a few *ares* to 9 and even more hectares.		

Bezeichnung.	GRÖSSE.		BEMERKUNGEN.	**Altersklasse.**	**Bonitätsklasse.**
	ha	**a**			

BEILAGE B.

STANDORTSTABELLE

MIT

UEBERSICHT DER ZUWACHSVERHÄLTNISSE

VOM

Bezeichnung.	Betriebsklasse.	STANDORTS													
		I		I/II		II/I		III		II/III		III/II		III	
		ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a
1															
2															
3															

BONITÄT.

III/IV		IV/III		IV		IV/V		V/IV		V		Summe.			
ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a

GESTEIN

Bezeichnung.	Betriebsklasse.	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a
1															
2															
3															

ARTEN.

ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a

BEILAGE C.

KLASSEN UND HOLZVORRATSÜEBRSICHT

VOM

Zu Anfang des Forstjahres.	NADELHOLZ.															
	I. Kl. 1—20 J.		II. Kl. 21—40 J.		III. Kl. 41—60 J.		IV. Kl. 61—80 J.		V. Kl. 81—100 J.		VI. Kl. über 100 J.		Verjüngungsklasse.		Summe.	
	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a

LAUBHOLZ, HOCHWALD.																							
ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a

NIEDERWALD.																							
ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a

										Summe der bestandenen Fläche.		Räumden.		Blossen		Summe des Holzbodens		Holzvorrat.	
ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	fm.	pr. ha.

BEILAGE D.

BONITIERUNGS-SKALA.

Oberirdische Bestandsmasse in Festmetern pro Hektar.

Fichte.

Alter.	5. Bon.		4. Bon.			3 Bon.			2 Bon.			1. Bon.	
Jahre	Festmeter.												
10	1	15	16	[illegible]	20	21	23	25	26	[illegible]	30	31	
15	17	26	27	33	38	39	41	49	50	[illegible]	61	62	[illegible]
20	23	36	37	46	55	56	[illegible]	73	74	[illegible]	91	92	100
25	31	49	50	[illegible]	78	79	[illegible]	106	107	[illegible]	134	135	[illegible]
30	38	61	62	[illegible]	100	101	[illegible]	138	139	[illegible]	176	177	[illegible]
35	47	74	75	[illegible]	125	126		176	177		227	228	[illegible]
40	[illegible]	86	87	118	150	151	[illegible]	213	214	[illegible]	277	278	[illegible]
45	[illegible]	98	99	[illegible]	177	178	[illegible]	264	265	[illegible]	332	333	[illegible]
50	[illegible]	110	111	[illegible]	203	204		295	296	[illegible]	387	388	[illegible]
55	[illegible]	122	123	[illegible]	230	231	[illegible]	337	338	[illegible]	444	445	[illegible]
60	[illegible]	133	134	195	256	257	[illegible]	378	379	[illegible]	501	502	[illegible]
65	90	144	145	[illegible]	283	284	[illegible]	420	421		608	609	[illegible]
70	97	155	156	[illegible]	309	310	[illegible]	462	463	[illegible]	615	616	[illegible]
75	103	166	167	[illegible]	335	336	[illegible]	503	504		671	672	[illegible]
80	110	176	177	[illegible]	360	361	[illegible]	543	544	[illegible]	726	727	[illegible]
85	117	186	187	[illegible]	384	385	[illegible]	581	582	[illegible]	778	779	[illegible]
90	122	195	196	[illegible]	407	408	[illegible]	618	619	[illegible]	829	830	[illegible]
95	[illegible]	204	205	[illegible]	429	430	[illegible]	653	654		877	878	[illegible]
100	[illegible]	212	213	[illegible]	450	451	[illegible]	687	688	[illegible]	924	925	[illegible]
110	[illegible]	227	228	[illegible]	488	489		748	749	[illegible]	1008	1009	[illegible]
120	[illegible]	239	240	[illegible]	519	520	[illegible]	799	800	[illegible]	1079	1080	[illegible]
130	[illegible]	248	249	[illegible]	544	545	[illegible]	839	840		1134	1135	[illegible]
140	[illegible]	254	255	[illegible]	559	560		865	866		1171	1172	[illegible]
150	[illegible]	257	258	[illegible]	569	570	[illegible]	880	881		1191	1192	[illegible]

Tanne.

Alter.	5. Bon.		4. Bon.			3. Bon.			2. Bon.			1. Bon.	
Jahre.	Festmeter.												
10	6	12	13	[illegible]	17	18	[illegible]	22	23	[illegible]	27	28	[illegible]
15	13	21	22	27	31	32		41	42	[illegible]	51	52	[illegible]
20	19	30	31	[illegible]	45	46	[illegible]	60	61	[illegible]	75	76	[illegible]
25	26	41	42	[illegible]	66	67	[illegible]	91	92	[illegible]	117	118	[illegible]
30	[illegible]	51	52	[illegible]	87	88	[illegible]	122	123	[illegible]	158	159	[illegible]
35	40	63	64	[illegible]	112	113	[illegible]	160	161	[illegible]	208	209	[illegible]
40	47	74	75	[illegible]	136	137	[illegible]	197	198	[illegible]	258	259	[illegible]
45	55	87	88	[illegible]	163	164	[illegible]	238	239	[illegible]	314	315	353
50	62	99	100	[illegible]	189	190	[illegible]	279	280	[illegible]	369	370	414
55	69	110	111	[illegible]	218	219	271	323	324	[illegible]	428	429	481
60	75	120	121	[illegible]	246	247	[illegible]	366	367	[illegible]	486	487	548
65	86	135	136	[illegible]	274	275	[illegible]	410	411	[illegible]	546	547	615
70	[illegible]	150	151	[illegible]	301	302	[illegible]	453	454	[illegible]	605	606	681
75	102	162	163	247	330	331	[illegible]	498	499	583	666	667	750
80	[illegible]	174	175	[illegible]	359	360	[illegible]	543	544	[illegible]	727	728	818
85	118	185	186	[illegible]	385	386	[illegible]	584	585	685	784	785	884
90	[illegible]	196	197	304	410	411	518	625	626	[illegible]	840	841	948
95	129	206	207	[illegible]	436	437	[illegible]	666	667	782	896	897	1012
100	[illegible]	216	217	[illegible]	461	462	[illegible]	706	707	[illegible]	951	952	1074
110	140	233	234	371	507	508	[illegible]	751	752	[illegible]	1055	1056	1192
120	[illegible]	247	248	[illegible]	549	550	700	850	851	[illegible]	1161	1162	1304
130	162	258	259	422	585	586	[illegible]	911	912	1074	1237	1238	1400
140	167	266	267	411	615	616	[illegible]	963	964	[illegible]	1311	1312	1486
150	170	271	272	455	638	639	623	1006	1007	[illegible]	1375	1376	1559

Oberirdische Bestandsmasse in Festmetern pro Hektar.

Kiefer.

Alter.	5. Bon.		4. Bon.			3. Bon.			2. Bon.			1. Bon.	
Jahre.	Festmeter.												
10	[illegible]	15	16	[illegible]	21	22	[illegible]	28	29	[illegible]	35	36	[illegible]
15	[illegible]	25	26	[illegible]	38	39	[illegible]	52	53	[illegible]	65	66	73
20	22	34	35	[illegible]	55	56	[illegible]	75	76	[illegible]	95	96	105
25	[illegible]	45	46	[illegible]	77	78	[illegible]	107	108	[illegible]	137	138	[illegible]
30	[illegible]	56	57	[illegible]	89	90	118	138	139	[illegible]	178	179	[illegible]
35	[illegible]	69	70	[illegible]	121	122	[illegible]	173	174	[illegible]	224	225	[illegible]
40	[illegible]	82	83	[illegible]	144	145	[illegible]	207	208	[illegible]	270	271	[illegible]
45	[illegible]	95	96	[illegible]	169	170	[illegible]	243	244	[illegible]	317	318	355
50	[illegible]	107	108	150	193	194	236	278	279	[illegible]	363	364	400
55	[illegible]	119	120	[illegible]	215	216	[illegible]	311	312	[illegible]	407	408	456
60	[illegible]	131	132	184	237	238	[illegible]	344	345	[illegible]	451	452	505
65	[illegible]	142	143	201	259	260	[illegible]	376	377	[illegible]	493	494	[illegible]
70	[illegible]	153	154	217	280	281	[illegible]	407	408	471	534	535	[illegible]
75	[illegible]	163	164	[illegible]	300	301	[illegible]	436	437	[illegible]	572	573	641
80	[illegible]	173	174	[illegible]	319	320	[illegible]	464	465	[illegible]	609	610	682
85	[illegible]	182	183	[illegible]	336	337	[illegible]	490	491	[illegible]	643	644	721
90	120	191	192	[illegible]	353	354	[illegible]	515	516	[illegible]	677	678	758
95	[illegible]	199	200	[illegible]	368	369	[illegible]	537	538	[illegible]	706	707	[illegible]
100	130	207	208	[illegible]	383	384	471	559	560	647	735	736	[illegible]
110	[illegible]	220	221	[illegible]	408	409	502	595	596	680	782	783	[illegible]
120	[illegible]	230	231	[illegible]	427	428	[illegible]	623	624	721	819	820	917
130	[illegible]	237	238	[illegible]	439	440	[illegible]	641	642	712	843	844	[illegible]
140	[illegible]	241	242	[illegible]	445	446	548	650	651	753	855	856	954

Lärche.

Alter.	5. Bon.		4. Bon.			3. Bon.			2. Bon.			1. Bon.	
Jahre.	Festmeter.												
10	12	18	19	23	28	29	33	38	39	43	48	49	63
15	19	30	31	39	48	49	57	66	67	75	84	85	93
20	26	41	42	54	67	68	80	93	94	106	119	120	132
25	33	53	54	72	90	91	109	126	127	145	163	164	182
30	40	64	65	88	112	113	136	159	160	183	206	207	230
35	48	76	77	106	136	137	166	195	196	225	255	256	285
40	55	87	88	123	159	160	195	231	232	267	303	304	339
45	62	98	99	141	183	184	225	267	268	310	352	353	394
50	68	109	110	158	206	207	255	303	304	352	400	401	443
55	75	120	121	174	227	228	281	335	336	389	443	444	497
60	82	130	131	189	248	249	308	367	368	427	486	487	546
65	88	140	141	204	268	269	333	397	398	461	525	526	590
70	93	149	150	219	288	289	357	426	427	495	564	565	634
75	99	158	159	232	306	307	380	453	454	527	600	601	674
80	105	167	168	245	323	324	401	479	480	557	635	636	713
85	110	175	176	257	339	340	421	503	504	585	667	668	749
90	116	183	184	269	354	355	440	526	527	612	698	699	784
95	119	190	191	280	369	370	459	548	549	638	727	728	817
100	123	197	198	290	383	384	476	569	570	662	755	756	[illegible]
110	131	209	210	309	408	409	508	607	605	707	806	807	906
120	137	218	219	324	429	430	535	640	641	746	851	852	957
130	141	225	226	336	446	447	557	668	669	779	890	891	1001
140	144	230	231	346	462	463	578	693	694	809	924	925	1040

Oberirdische Bestandesmasse in Festmetern pro Hektar.

Buche

Alter.	5 Bon.		4. Bon.			3. Bon.			2. Bon.			1. Bon.	
Jahre.	Festmeter.												
10	[illegible]	11	12	13	15	16	[illegible]	18	19	[illegible]	21	22	
15	11	17	18	[illegible]	23	24		30	31	[illegible]	36	37	[illegible]
20	11	22	23		31	32	[illegible]	41	42	[illegible]	51	52	
25	18	29	30	[illegible]	43	44	[illegible]	57	58		71	72	[illegible]
30	23	36	37	[illegible]	54	55	[illegible]	72	73	[illegible]	90	91	[illegible]
35	28	44	45	[illegible]	68	69	[illegible]	91	92	[illegible]	114	115	[illegible]
40	33	52	53	[illegible]	81	82		109	110	[illegible]	137	138	
45	38	61	62	[illegible]	96	97	[illegible]	130	131	[illegible]	164	165	[illegible]
50	[illegible]	70	71	[illegible]	111	112	[illegible]	151	152	[illegible]	191	192	
55	[illegible]	80	81	[illegible]	128	129	[illegible]	175	176		222	223	
60	[illegible]	89	90	[illegible]	144	145	[illegible]	198	199	[illegible]	252	253	
65	[illegible]	99	100	[illegible]	162	163	[illegible]	224	225	[illegible]	286	287	
70	[illegible]	109	110	[illegible]	180	181	[illegible]	250	251	[illegible]	320	321	
75	[illegible]	119	120	[illegible]	199	200	[illegible]	278	279		357	358	
80	81	129	130	[illegible]	218	219	[illegible]	306	307		394	395	
85	87	139	140	[illegible]	236	237		334	335		431	432	
90	[illegible]	148	149	[illegible]	254	255		361	362		468	469	
95	98	157	158	[illegible]	272	273	[illegible]	388	389	[illegible]	503	504	[illegible]
100	103	165	166	[illegible]	290	291		414	415		538	539	
110	[illegible]	179	180	[illegible]	320	321		461	462		602	603	
120	[illegible]	190	191	[illegible]	347	348	[illegible]	504	505		661	662	[illegible]
130	[illegible]	198	199	[illegible]	371	374		543	544	[illegible]	715	716	
140	[illegible]	204	205		391	392		577	578		763	764	
150	[illegible]	208	209	[illegible]	407	408		607	608		807	808	[illegible]
160	[illegible]	211	212		422	423		634	635		846	847	
170	[illegible]	213	214		436	437		658	659		880	881	[illegible]
180	[illegible]	216	216		447	448		679	680		911	912	[illegible]
190	[illegible]	217	218		458	459		698	699		938	939	
200	[illegible]	218	219		467	468		715	716		963	964	[illegible]

Eiche.

Alter.	5 Bon		4. Bon.			3. Bon.			2. Bon.			1. Bon.	
Jahre.	Festmeter.												
10	[illegible]	8	9	[illegible]	12	13	[illegible]	15	16		18	19	
15	[illegible]	15	16	[illegible]	21	22	[illegible]	27	28	[illegible]	33	34	[illegible]
20	[illegible]	21	22	[illegible]	29	30	[illegible]	38	39	[illegible]	47	48	[illegible]
25	[illegible]	29	30		40	41		52	53	[illegible]	64	65	[illegible]
30	[illegible]	36	37	[illegible]	51	52	[illegible]	66	67	[illegible]	81	82	[illegible]
35	[illegible]	45	46		64	65	[illegible]	82	83	[illegible]	101	102	110
40	[illegible]	53	54	[illegible]	76	77	[illegible]	98	99	[illegible]	120	121	[illegible]
45	[illegible]	62	63	[illegible]	89	90	[illegible]	115	116	[illegible]	143	144	155
50	[illegible]	71	72	[illegible]	101	102	[illegible]	132	133	[illegible]	163	164	[illegible]
55	[illegible]	81	82	[illegible]	117	118	[illegible]	152	153	[illegible]	188	189	[illegible]
60	67	91	92	[illegible]	132	133	[illegible]	172	173	[illegible]	212	213	[illegible]
65	[illegible]	102	103	[illegible]	148	149	[illegible]	193	194	[illegible]	239	240	[illegible]
70	[illegible]	112	113	[illegible]	163	164	[illegible]	214	215	[illegible]	265	266	[illegible]
75	77	122	123	[illegible]	180	181	[illegible]	237	238	[illegible]	294	295	[illegible]
80	[illegible]	132	133	[illegible]	196	197	[illegible]	259	260	[illegible]	322	323	[illegible]
85	[illegible]	142	143	[illegible]	212	213	[illegible]	282	283	317	351	352	[illegible]
90	[illegible]	151	152	190	228	229	[illegible]	304	305	[illegible]	380	381	419
95	[illegible]	160	161	[illegible]	244	245	[illegible]	327	328	[illegible]	411	412	[illegible]
100	[illegible]	169	170	[illegible]	259	260	[illegible]	350	351	[illegible]	441	442	487
110	117	186	187	[illegible]	291	292	[illegible]	397	398	450	503	504	[illegible]
120	[illegible]	201	202	262	323	324	[illegible]	444	445	[illegible]	565	566	[illegible]
130	[illegible]	215	216	[illegible]	352	353	[illegible]	488	489	[illegible]	634	635	[illegible]
140	[illegible]	228	229	[illegible]	380	381	[illegible]	531	532	[illegible]	692	693	758
150	[illegible]	240	241	[illegible]	406	407	[illegible]	571	572	[illegible]	766	767	[illegible]
160	[illegible]	251	252	[illegible]	431	432	[illegible]	610	611	700	789	790	879
170	[illegible]	261	262	[illegible]	454	455	[illegible]	646	647	742	839	840	[illegible]
180	169	270	271	[illegible]	475	476	[illegible]	679	680	781	868	869	[illegible]
190	[illegible]	277	278	[illegible]	493	494	[illegible]	709	710	[illegible]	925	926	[illegible]
200	177	283	284	[illegible]	508	509	[illegible]	734	735	847	960	961	1073

Oberirdische Bestandsmasse in Festmetern pro Hektar.

Erle

Alter.	5. Bon.		4. Bon.			3. Bon.			2. Bon.			1. Bon.	
Jahre.	Festmeter.												
10	[illegible]	17	18	[illegible]	29	30	[illegible]	41	42	[illegible]	53	54	60
15	[illegible]	27	28		45	46	[illegible]	64	65	[illegible]	82	83	[illegible]
20	24	38	39	51	63	64	[illegible]	88	89	101	113	114	128
25	[illegible]	49	50	[illegible]	81	82	[illegible]	112	113	[illegible]	144	145	[illegible]
30	[illegible]	61	62	[illegible]	99	100	[illegible]	138	139	[illegible]	176	177	[illegible]
35	[illegible]	72	73	[illegible]	118	119	[illegible]	163	164	[illegible]	209	210	[illegible]
40	53	84	85	111	136	137	[illegible]	188	189	[illegible]	240	241	[illegible]
45	[illegible]	95	96	[illegible]	154	155	[illegible]	213	214	[illegible]	272	273	[illegible]
50	[illegible]	105	106	[illegible]	171	172		237	238	[illegible]	304	305	[illegible]
55	[illegible]	116	117	[illegible]	188	189		261	262	[illegible]	332	333	[illegible]
60	[illegible]	126	127	[illegible]	204	205	[illegible]	284	285	[illegible]	362	363	401
65	[illegible]	136	137	[illegible]	220	221	[illegible]	307	308	[illegible]	391	392	[illegible]
70	[illegible]	145	146	[illegible]	235	236	[illegible]	329	330	[illegible]	419	420	[illegible]
75	[illegible]	154	155	[illegible]	250	251	[illegible]	351	352	[illegible]	447	448	[illegible]
80	[illegible]	162	163	[illegible]	265	266	[illegible]	372	373	[illegible]	474	475	[illegible]
90	[illegible]	178	179	[illegible]	293	294	[illegible]	412	413	[illegible]	526	527	[illegible]
100	[illegible]	192	193		318	319	[illegible]	448	449	[illegible]	572	573	[illegible]

Birke.

Alter.	5. Bon.		4 Bon.			3. Bon.			2 Bon.			1. Bon.	
Jahre.	Festmeter.												
10	8	13	14	[illegible]	22	23	[illegible]	32	33		43	44	47
15	[illegible]	19	20	[illegible]	34	35	[illegible]	50	51	[illegible]	65	66	74
20	18	25	26	36	46	47	57	67	68	78	88	89	99
25	[illegible]	34	35	49	62	63	77	90	91	[illegible]	118	119	133
30	27	42	43	60	77	78	[illegible]	112	113	130	147	148	165
35	33	52	53	[illegible]	94	95	[illegible]	136	137	[illegible]	179	180	201
40	38	61	62	86	110	111	[illegible]	160	161	186	210	211	[illegible]
45	43	69	70	[illegible]	126	127	[illegible]	183	184	212	240	241	[illegible]
50	[illegible]	77	78	[illegible]	141	142	[illegible]	205	206	[illegible]	269	270	301
55	52	83	84	118	153	154	189	224	225	260	294	295	330
60	[illegible]	88	89	[illegible]	165	166	204	242	243	281	319	320	358
65	57	91	92	133	174	175	216	256	257	298	339	340	381
70	59	94	95	[illegible]	182	183	[illegible]	270	271	[illegible]	358	359	402
75	60	96	97	[illegible]	188	189	[illegible]	280	281	327	373	374	420
80	61	97	98	[illegible]	193	194	[illegible]	290	291	[illegible]	387	388	[illegible]
90		.	.		.	.		.	.		.	.	
100	.	.	.	.	.	.		.	.	.	.	.	.

Oberirdische Bestandesmasse in Festmetern pro Hektar.

Mittelwald.

(a) Unterholz nach der entsprechenden Skala des Niederwaldes.
(b) Oberholz ohne Rucksicht auf die Holzart nach folgender Skala.

5. Bon.		4. Bon.		3. Bon.		2. Bon.		1. Bon.
Festmeter.								
20	50	51	110	111	170	171	230	231

c) Mittelwald-Bonität als Mittel aus der Bonitätsziffer für Unterholz und Oberholz mit überwiegendem Einfluss der letzteren.

Niederwald von Weiden, Pappeln, Erlen, &c.

Alter.	5. Bon.		4. Bon.		3. Bon.		2. Bon.		1. Bon.	
Jahre.	Festmeter.									
5	2	5	6	14	15	22	23	30	31	
10	6	11	12	28	29	44	45	60	61	
15	11	22	23	47	48	71	72	95	96	
20	17	33	34	66	67	98	99	130	131	
25	21	41	42	84	85	127	128	169	170	
30	25	49	50	102	103	155	156	208	209	
35	28	55	56	118	119	181	182	244	245	276
40	30	60	61	133	134	206	207	279	280	311

Niederwald von Eichen, Buchen, Eschen, Birken, &c.

Alter.	5. Bon.		4. Bon.			3. Bon.			2. Bon.			1. Bon.	
Jahre.	Festmeter.												
5	1	3		6	8	9	11	14	15	17	19	20	22
10	3	6	7	12	17	18	23	28	29	34	39	40	45
15	6	11	12	20	25	29	36	44	45	53	61	62	69
20	8	16	17	27	38	39	49	60	61	71	82	83	93
25	12	23	24	37	51	52	65	79	80	93	107	108	121
30	15	30	31	47	63	64	80	97	98	114	131	132	148
35	18	35	36	54	73	74	93	113	114	133	152	153	172
40	20	39	40	61	83	84	106	128	129	151	173	174	196

BEILAGE E.

ABNUTZUNGSTABELLE

VON

N. B.—The data to be entered in this statement are given for successive years if possible; otherwise for 10-year periods.

ES WURDEN

Im Jahre.	Derbholz.			Reisig.			Gesammtmass		
	Laubholz	Nadelholz	Summe.	Laubholz.	Nadelholz.	Summe.	Laubholz.	Nadelholz	Summe
	Festkubikmeter.			Festkubikmeter.			Festkubikmeter.		

GESCHLAGEN:							Bemerkung.
Gemeinjährig.				Stockholz.			
Derbholz.			Gesammtmasse.				
Laubholz.	Nadelholz.	Summe.		Laubholz.	Nadelholz.	Summe	
Festkubikmeter.				Raumkubikmeter.			

BEILAGE E'.

ZWISCHENNUTZUNGSTABELLE

VOM

REVIER

Grösse der holzbodenfläche nach der letzten Aufstellung.	im Jahre.	DIE ZWISCHENNUTZ-							
		Derbholz.		Reisig.		Gesammtmasse.		Gemeinjäh-	
								Derbholz.	
		Ueberhaupt.	dav. Laubholz.	Ueberhaupt.	dav. Laubholz	Ueberhaupt.	dav. Laubholz	Ueber, haupt.	dav. Laubholz.
Hr.		Fm.		Fm.		Fm.		Fm.	

UNG BETRUG			DIESELBE ZERFÄLLT IN						BEMERKUNGEN.
RIG.			DURCHFORSTUNG.			LÄUTERUNG.	ZUFALLIGE NUTZUNG		
Gesammtmasse.									
Ueberhaupt.	dav. Laubholz	pr. Hr. d. holzbd fl.	Grosse d Dfst -Fl.	Ueberhaupt.	pr Hr d. Dfst -Fl.	Ueberhaupt	Ueberhaupt.	pr. Hr. d Holzbdfl	
Fm.			Hr.	Fm.		Fm.	Fm.		

BEILAGE F.

ETATSBEGRÜNDUNG.

N.B.—In this Appendix the whole subject of the treatment is considered and discussed in great detail.

BEILAGE G

ALLGEMEINE WIRTHSCHAFTSREGELN.

1. In die zum Hieb gesetzten Bestande schieben sich nicht selten kleine vorspringende Flachen von Orten ein, welche nicht zum Abtrieb vorliegen. In solchen Fallen brauche man sich bei den Hauungen nicht angstlich an die auf den Karten angegebenen Bestandslinien zu halten, sondern dergleichen unbedeutende Ecken konnen, ebenso wie etwa anstossende unterdruckte Rander und Horste mit hinweggenommen werden, um angemessene Schlaggrenzen zu erlangen

2 Es ist nicht nothig, bei nur theilweis zum Hieb gestellten Orten sich peinlich streng an die im Hauungsplane enthaltenen Flachen zu binden, sondern man kann nach Befinden etwas mehr oder weniger nehmen, wie dies eine uber die fraglichen Orte zu legende gute Schlaggrenze erfordert.

3. Bei Auswahl und Feststellung der zu verjungenden Orte ist schon insoweit, als es die Bestandsverhaltnisse erlauben, darauf Bedacht genommen worden, grosse Hiebsflachen im Zusammenhange zu vermeiden und durch Herstellung kleinerer auf das bessere Gedeihen der Kulturen wirken zu konnen Aber auch durch eine angemessene specielle Vertheilung der zunachst zum Hiebe vorliegenden Orte lasst sich noch viel zur Erreichung dieses Zweckes thun, namentlich dadurch, dass man die zur Hauung gestellten grosseren Bestande und unter diesen vorzugsweise diejenigen, welche nicht an schon vorhandene grosse Kulturflächen grenzen, zunachst in Anhieb nimmt, den Abtrieb der kleineren Orte aber als das Mittel benutzt, um in den grosseren Hiebsflachen die Schlage einmal langer ruhen lassen zu konnen. Im Uebrigen ist es besser, den einzelnen Jahresschlag etwas grosser anzulegen, als zu oft einen neuen anzureihen.

Ausgenommen von obiger Bestimmung sind die Loshiebe, deren Ausfuhrung in der Regel moglichst rasch zu erfolgen hat.

4 Abgesehen von den zur Vorverjungung bestimmten Bestanden darf ausserhalb des nachsten Jahresschlages in den Hiebsorten nur dann gelichtet werden, wenn es sich um die Begunstigung tauglichen Unterwuchses handelt, welchen man zu erhalten wünscht, wobei die Abgabe von einigen wenigen Stammen besonderer Qualität auch aus spater an die Reihe kommenden Schlagen nicht abgeschnitten sein soll.

5 Unter Durchforstung ist zu verstehen

(*a*) in geschlossenen Jungorten oder Stangenholzern, auch wenn sie erst noch in das Stadium der Reinigung eintreten, die systematische Entnahme zunachst der unterdruckten, und beherrschten, in sehr dicht erwachsenen Jungorten auch herrschender Stammindividuen, ehe dieselben abstandig und weniger brauchbar werden, oder ganz ungenutzt verkommen, im Wesentlichen also solcher Exemplare, welche uberhaupt zum dauernden Bestandesschluss nicht beitragen bez nicht erforderlich sind, durch deren Entnahme vielmehr dieser, sowie die Beschaffenheit und der Zuwachs des Hauptbestandes nicht nur nicht gefahrdet wird, sondern beides, bei der alsdann voraussichtlich durch vermehrten Lichteinfall eintretenden reichlicheren Blattentwickelung und Beastung sich steigern kann.

(*b*) in alteren, namentlich aber in solchen der Haubarkeit sich nähernden Orten in welchen die letztgenannte Entwickelung nicht mehr in Aussicht steht, lediglich die Entnahme derjenigen Stamme, die weder zum Bestandsschluss, noch zum Bodenschutz weiter beitragen, also in der Hauptsache der vollig unterdruckten Individuen.

Es wird darauf zu halten sein, dass die in den Wirthschaftsplanen zur Durchforstung angesetzten Orte auch wirklich durchforstet werden Deshalb ist diese Massregel selbst dann durchzufuhren, wenn dabei eine Etatsuberschreitung zu befurchten steht, und ist in solchem Falle lieber eine angemessene Hiebsflache in Beständen besserer Bonitat zurückzulassen

Dabei wird angenommen, dass das gewonnene Material auch verwerthbar sei, indem Durchforstungen, welche einen grosseren Aufwand verursachen und bei denen die Kosten durch den Erlos von dem verkauften Material nicht gedeckt werden, nur in besonderen Fallen und mit Genehmigung des Konigl Finanz-Ministeriums zulassig erscheinen.

Ueberall dagegen, wo schwache Holzsortimente Absatz finden, sind ausser den Beständen III. und IV. Altersklasse namentlich auch diejenigen der II. Altersklasse zu durchforsten, weil in diesen der Nutzen der Durchforstung in Bezug auf die Vermehrung des Zuwachses an dem stehenbleibenden Bestande nicht nur am grössten ist, sondern auch die Holzsortimente, welche hierbei gewonnen werden, zum grössten Theil, ohne irgend eine Einnahme für die Forstkasse zu gewähren, verloren gehen würden, wenn die Durchforstung unterbliebe, während solches in den Orten IV. Altersklasse, des nahe bevorstehenden Abtriebes wegen, seltener zu befürchten ist.

Bezüglich des Lichtungsgrades wird nur bemerkt, dass — wenn nicht besondere Umstände, z. B. armer, leicht verödender Boden, sehr dichter zeitheriger Bestandesschluss eine schwache und in kürzeren Zeiträumen wiederkehrende Entnahme räthlich erscheinen lassen — die Durchforstung in einer solchen Stärke auszuführen ist, dass eine frühere Wiederkehr derselben, als nach 5 Jahren, nicht erforderlich wird.

Alle nach Süden und Westen liegenden Bestandessaume sind, *sofern eine Reinigung noch nicht eingetreten ist*, längs der äusseren Grenzen, der Wirthschaftsstreifen und breiteren Wege und der zum Forstareal gehörenden Felder und Wiesen, &c. besonders stark zu durchforsten, um auf diese Weise die Mantelbildung zu befördern und eine grössere Sicherung gegen Sturmschaden zu erlangen.

Überall dagegen, wo der Bestand sich bereits gereinigt hat, wo also dieser Vortheil nicht mehr erreicht werden kann, sind die nach den genannten Himmelsgegenden hin gelegenen Ränder 10—15 Meter breit undurchforstet zu lassen, order wenigstens mit äusserster Vorsicht zu durchforsten.

Übrigens kann in dem Falle, dass der Zustand einzelner Orte im Laufe der Zeit sich wesentlich verändert hat, es ebensowohl räthlich werden, auch noch andere als die im Durchforstungsplane enthaltenen Bestande zu durchforsten, als umgekehrt den einen oder anderen der zur Durchforstung angesetzten Orte mit dieser Massregel zu verschonen.

6. Durch rechtzeitige und sachgemässe Läuterung, durch das Zurückschneiden der Schutzholzarten, sobald und insoweit sie schädlich wirken, durch Ausschneiden wuchernder Unkraüter mit einem Worte: durch fleissige Bestandespflege ist die Entwickelung der jungen Anlagen möglichst zu fördern. Bei allen diesen Arbeiten ist auf die Erhaltung und Vermehrung der Bodenkraft ein grosses Gewicht zu legens.

7. Im Anschluss an den, in Bezug auf die Durchforstung der Bestandesränder unter Punkt 5 ausgesprochenen Grundsatz erscheint es zweckmässig, bereits beim Anbau denselben zu berücksichtigen und demgemäss Kulturen, welche an solchen Stellen auszuführen snd, weitläufiger (mit grösseren Abständen, und am vortheilhaftesten im gleichseitigen Dreiecksverband) als sonst üblich, ebenfalls 10—15 Meter breit vom Rande herein, anzulegen.

8. Insoweit nicht über die Freistellung von nicht berainten Chausseen, Strassen und gebauten Wegen besondere Anordnungen bereits bestehen, wird bestimmt, dass an alle gebaute und überhaupt besonders wichtige breitere Wege künftig nicht näher heran kultivirt werde, als dass die nächsten Pflanzen 3 Meter (incl. der Gräben) von dem Planierande entfernt bleiben. Bei denjenigen gebauten Wegen, Strassen, &c., welche in der Richtung von Ost nach West verlaufen, ist auf der Südseite der Wege 4 Meter und auf der Nordseite 3 Meter als Entfernung der ersten Kulturreihe vom Planierande festzuhalten. Bis zu dieser Breite sind auch überall, wo junge Orte anstossen, die sich noch nicht gereinigt haben und bei denen mithin die Möglichkeit zur Bildung künstiger Randbäume noch besteht, unverweilt die nöthigen Räumungen vorzunehmen. Ebenso empfiehlt es sich, an die Grenzen der Felder und Wiesen, auch wenn letztere nicht zum Reviere gehören, in der Regel nicht näher als ca. 4 Meter heran zu kultiviren.

9. Beim Abschneiden der Bäume ist die Ausbeute an Derb bez. Nutzholz durch die möglichste Anwendung des Tiefabschnittes zu vermehren. Die Stockhöhe von 0.5 Meter ist nicht die vorgeschriebene, sondern nur das zulässige Maximum derselben, welches, ausnahmsweise durch zwingende Umstände veranlasst, in Anwendung gebracht werden darf. Dass an steilen Hängen, an den Bestandsränderen von Los-und Durchhieben, sowie bei Einzelnutzungen ohne Ausnahme die Bäume hart an dem Boden abzuschneiden sind und die Stöcke nicht gerodet werden dürfen, ist selbstverständlich.

10. Das Bepflanzen der Beetgänge in den Wanderkämpen zur Pflanzenerziehung hat sogleich bei der Anlage zu erfolgen.

Part III.

SPECIELLER WIRTHSCHAFTSPLAN.

(*The Working Scheme*)

N. B.—The working scheme does not fix the sites for any of the fellings, their selection being left entirely to the discretion of the Executive Officer, who lays out his coupes and plants or sows wherever he judges best.

____________________________Revier

HAUUNGSPLAN,

AUF DIE

__ ______ Jahre 18____________ b.m. 18________________

(*Prescriptions for entire 10-year period.*)

ABTRIEBSNUTZUNG.

Forstort.	Bestandesart, Alters- und Bonitätsklasse.	ganz oder davon	Fläche.		Masse in Festmetern.				Bemerkungen.
					Laubholz.		Nadelholz.		
			ha	a	1 ha	überhaupt.	1 ha	überhaupt.	

ABTRIEBSNUTZUNG

Nachweis über die stattgehabte Ausführung

Bezeichnung.	18		18		18		18		18		Summe.	
	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a

ZWISCHENNUTZUNG.

Die Zwischennutzungen hat man für das Jahrzehnt 18______mit

veranschlagt.

Diese Masse wird zu erlangen sein :

(1) durch die an Bruch- und dürren Hölzern pp. sich ergebenden zufälligen Nutzungen ;

(2) durch die regelmässigen Durchforstungen insbesondere in nachstehenden Beständen.

Bemerkung.—In den Beständen, von denen nur Theile zur Durchforstung angesetzt sind, kommen entweder Partieen vor, welche nicht durchforstungsbedürftig sind, oder man hat dieselben theilweis zum Abtrieb bestimmt.

DURCHFORSTUNGS-PLAN.

Forstort.		ganz oder davon,	Fläche.		Bemerkungen.
Bezeichnung.	Bestandsart, Alters und Bonitätsklasse.		ha	a	

NUTZUNG.

AUSFÜHRUNG.

Jahr.	Fläche.		Derbholz.		Reisig.	Summa.	BEMERKUNGEN.
			Nutzholz	Brennholz.			
	ha	a	fm	fm	fm	fm	

ZWISCHENNUTZUNG.

Bezeichnung.	Art der Wirthschaftsmassregel.	Ausführung.		
		Jahr.	Ertrag, fm	Bemerkungen.

GESAMMTNUTZUNG.					
Grösse der zu verjüngenden Fläche.		Masse in Festmetern.			Bemerkungen.
ha	a	Laubholz.	Nadelholz.	Ueberhaupt.	

JÄHRLICHER ETAT für die Jahre 18
. . . . Festmeter,
als
. . . . fm Laubholz und
. . . Nadelholz,

S. w. o.

welche zu verschlagen sind mit:
. . . . fm Derbholz,
als
. . . . fm Laubholz und
. . . . Nadelholz,

S. w. o.

worunter
. . . . fm Nutzholz,
als
. . . . fm Laubholz und
. . . . Nadelholz,

S. w. o.

und mit
. . . . fm Reisig,
als
. . . . fm Laubholz und
. . . . Nadelholz.

S. w. o.

Hieruber . . . . rm Stockholz,
als
. . . . rm Laubholz und
. . . . Nadelholz.

S. w. o.

SPECIELLER KULTURPLAN

AUF DIE____________________JAHRE

VON_______________BIS MIT________________

VOM

____

(*Prescriptions for 5 years.*)

KULTUREN.

Bezeichnung.	Blössen.		Ausbesserungen.		Verjüngungen.		Bemerkungen.
	ha	a	ha	a	ha	a	

NACHWEIS UEBER STATTGEHABTE AUSFUHRUNG.

Bezeichnung.	18		18		18		18		18		Summe.		Bemerkungen.
	ha	a	ha	a	ha	a	ha	a	ha	a	ha	a	

III.—THE FOREST OF VIERNHEIM, GRAND DUCHY OF HESSE.

Forest Regeneration with Simultaneous Field Crops.

Underplanting, with Plenary Thinnings.

Before describing the system of treatment followed in the forest of Viernheim, it may prove interesting to give a few statistics regarding the State in which it is situated.

The area of the State is 1,898,183 acres, of which 592,151, or nearly 32 per cent., is forest. The forest area is thus distributed according to ownership —

Belonging to the State . . .	164,687	acres	or	27·7	per cent.
„ „ Communes . .	222,687	„	or	38 5	„
„ „ Private Individuals .	204,777	„	or	33·8	„

Both State and communal forests are under State management and grouped into 73 *Oberförstereien* or Ranges controlled by 6 Oberforstmeisters, who have under them respectively 14, 13, 15, 10, 10 and 11 Ranges. The Oberforstmeisters are under the direction of a State Council of 7 members, of whom three are foresters, two financiers, one a lawyer and one an official in charge of mines. One of the three forest members is the Forest Director and is *ex-officio* President of the Council. Thus, irrespective of *Assistents*, who become Oberförsters as vacancies occur, there are 82 professional officers of the highest education and of long experience for the management of 604 square miles of forests. In India we have not this number for the same area even when we include every one down to the lowest guard. The average size of a range is less than 9 square miles. Until 1st April of this year there were 9 Oberforstmeisters.

The gross forest revenue of the State for 1894 was 1,848,712 marks = £92,435 or an average of 11*s*. 2*d*. per acre.

The Forest of Viernheim.

This State forest, extending over 7,094 acres, is situated in the plain of the Rhine basin about 330 feet above the level of the sea. It stretches over rolling sandy downs. The soil is mostly silicious sand, especially on the higher undulating ground, which is hence only suitable for pine. The depressions are suited also for oak and beech.

The Commune of Viernheim possesses the following rights :—(1) to take as much as it can use of the branch wood, roots and root stocks of pines ; (2) to receive 176,750 stacked cubic feet of firewood in addition to (1) ; (3) to appropriate for *bonâ fide* home consumption all non-timber-yielding species, in other words, all save oak, pine and spruce ; and (4) to graze cattle, pigs and goats. Cattle are no longer sent out into the forest, as their manure is too precious to be lost. The number of pigs varies from thirty to forty and the goats sometimes exceed 60. The commune originally possessed rights also over the timber trees, but these were extinguished by paying it a compensation of £2,080. The extensive rights with which the forest is burdened effectually prevent the adoption of the best mixture of species, for everything must be done to exclude, as much as possible, species other than oak, pine and spruce, and when, under a sylvicultural necessity another species, such as beech, has to be introduced, it must be kept down so as to occupy and utilize as little of the soil as possible.

The problem was an extremely difficult one, but it has been grappled with great skill, and the following solution has, for the present at least, been adopted. The extensive cultivation of spruce in such a soil and at such a low elevation is out of the question. So that there is no choice but to grow oak and Scots' pine; but neither of these species is a soil-improver, and the naturally mediocre and dry soil of the forest must deteriorate unless a soil-improving species is mixed. If such a species is to be introduced simultaneously with oak and pine, it must necessarily occupy a considerable amount of space both in the soil and in the leaf-canopy to the benefit of the commune and the disadvantage of the State. It must, therefore, be introduced only after the oak has taken complete possession of the soil and stands well above the ground. Hence the species must be a shade-enduring one, and not only this, but also capable of being kept down in little more than the condition of a mere ground-covering to protect and enrich the soil. The choice has therefore obviously fallen upon the beech, which is accordingly underplanted when the oak and pine are about 40 years old, and is cut back for coppice as often as it reaches a diameter of about five inches, so that it has no chance of ever competing with the over-topping trees of the economically more valuable kinds.

The introduction of the beech so late as 40 years after the forest has grown up, has no disadvantage for the soil, because up to that age oak is able to shelter the ground more or less effectively.

The question of rights also places the pine under a great disadvantage as compared with the oak, for whereas every bit of the oak, except what may have to go to make up the annual right-holders' 176,750 stacked cubic feet, belongs to the State, the wants of the commune, which is a prosperous, growing borough, may increase to the extent of requiring all the firewood the pine can yield.

But the pine labours under another very serious disadvantage which of itself would suffice to make it yield the place to the oak wherever this species could grow and thrive. It has, besides the numerous fungus diseases to which it is subject, a host of most destructive insects to which it hopelessly succumbs, the *Trachea piniperda*, *Bombyx pinivora*, *Liparis Monacha*, *Fidonia piniaria*, *Sphinx Pinastri*, etc. Thousands of acres of dead and dying pines are a sufficient warning to deter any one from growing pine pure or even on a large scale, although its wood sells just as high as oak and it grows very much faster (produces 170—180 c.ft. per acre per annum against scarcely 80 c.ft. of the oak).

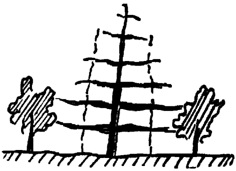
Hence the pine is grown, where the soil is not merely suitable for it alone, principally and even exclusively as a nurse, as the oak is unable to stand the severe frosts which prevail. Moreover, as the pine is a rapid grower, it helps to a considerable extent to push up the oak faster than this latter would get on of itself.

Having now explained how the forest officers in charge have, by very skilful observation and reasoning, come to select the oak as the principal species for the forest, the pine as a nurse, and the beech as a soil preserver and fertiliser when the oak is too old to continue to perform that rôle, I will describe the procedure followed.

The regeneration is effected by means of a clear felling immediately followed up by the sowing of oak and the planting of 1 year old pines in lines 1 metre (nearly 40 inches) apart, the intervals between the lines being sown with field crops—potatoes for the first two years, rye in the third year, at the end of which the forest seedlings are found to be strong enough to struggle up through, and suppress, the little grass that comes up when the field cultivation has been abandoned. The constant hoeing and weeding required during the first two years for the potato crops cleans the soil so thoroughly that hardly any weeds are able to introduce themselves before the forest seedlings meet their crowns and close up over the ground. Even broom and heather, in spite of the strongly silicious character of the soil, are to be seen only in one corner of the whole area and there the forest growth has not been quite successful. Moreover, the high cultivation which the soil undergoes enables the seedlings to push up with great rapidity. This system of combining an agricultural crop with young forest growth (in German *Waldfeldbau* or *Landwirthschaftlicher Zwischenbau*) is known by the name of its author, Kernheim.

Until recently the lines of oak and pine alternated, one of oak, then one of pine, and so on. But owing to the much more rapid growth of the pine and the consequent trouble of preventing it from suppressing the oak, the system now followed is to alternate two lines of oak with one of pine. The result is also a great saving in the cost of regeneration, for the planting of the pine is a much more expensive operation than the mere sowing of acorns. To reduce the cost still further, the pines in each line are now put down as much as 1½ metres apart (originally they were planted very much closer together). As regards the lines of oak, the acorns are sown almost touching one another, so that the seedlings come up almost in a continuous line.

The pines push up so rapidly that it is not long before the forester has to step in to save the oak from suppression, and he has to return for the same purpose at frequent intervals. The first operation is undertaken as soon as the pines begin to press up against the oaks and consists in cutting down the branches of the pine vertically, as indicated by the dotted lines in the diagrammattic sketch opposite (very graphically designated in German by the term *Coulissenschlag*). In the next few years the pines have not only spread out again, but have even very much overtopped the oaks. This time the mere shortening of the branches would not suffice, and it is necessary to head down



the pines to about four feet below the level of the oaks (*Kopfschlag*). Even after this second operation the lateral branches of the pines bend upwards and push on past the oaks, so that in a few years a second heading down becomes urgent. The first heading down is effected between the age of 12 and 18 years, according to the rapidity with which the young trees have grown, and the oak is sometimes not safe until after the third such operation. The vigour and vitality which the pine displays are quite remarkable; a delay of two or three years in the *Coulissenschlag* and first *Kopfschlag* is sufficient to throw back the oak hopelessly. Indeed the behaviour of the young pine is more like that of a rapid-growing shade-enduring species: the pine branches push themselves forward into the oak crowns and develop with the utmost vigour even when, through being headed down, the pines are much below the level of the oak. I saw some compartments where the necessity of cover for game caused the *Coulissenschlag* to be put off for a few years with the result that, in the opinion of the Oberförster, it is now too late to do anything to save the oak; the pine has thus been left to grow on undisturbed and will not be long in completely killing out the oak.

Towards the fortieth year of the crop, when the leaf-canopy has of itself opened out a little, beech is underplanted, and, as has been said above on page 110, it is cut back for coppice as often as it reaches a diameter of about 5 inches.

The ordinary thinnings are followed, at about the age of 80 years, by a pretty severe one termed *Nachlichtungshieb**, which is made with the object of securing rapid diametral increment for the trees in the upper storey, the beech in the lower storey being now quite competent to shelter the soil. At the age of 160 years the crop is cleared and the whole process is begun over again.

In the areas where pine almost pure has to be grown on account of the nature of the soil, the rotation is 120 years.

The yield of wood per acre per annum is 86 cubic feet, worth on an average 15*s.* 9½*d.* net. If the price of the agricultural crops, etc., be added the net return per acre per annum is about 16*s.* 2*d.*

Below are given the net prices obtained last year :—

Timber		Oak spars (Oak is too young yet to yield saw timber)	6·74*d.*	per cubic foot.
		Pine spars and logs (all fit for sawing up)	6·76*d.*	
Fire-wood.	Split	Beech (not large enough to be split up)		per 100 stacked cubic feet = 70 solid cubic feet.
		Oak	19*s.* 1*d.*	
		Pine	17*s.* 11*d.*	
	Round Billets	Beech	16*s.* 11*d.*	per 100 stacked cubic feet = 60 solid cubic feet.
		Oak	13*s.* 7*d.*	
		Pine	11*s.* 11*d.*	
	Root-stocks.	Beech (none yet)		per 100 stacked cubic feet = 50 solid cubic feet.
		Oak (scarcely any)		
		Pine	6*s* 1*d.*	
	Faggots	Oak	7*s.* 8*d.*	per 100 faggots = 70 solid cubic feet.
		Pine	5*s.* 2*d.*	

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* Styled Plenary Thinning in my Manual of Indian Sylviculture.

The mean net price per cubic foot obtained for all classes of wood during the 16 years from 1880 to 1895 has been 1·836*d*. This year it was 2·037*d*.

The present system of management dates only a few decades back, and when the oak has had time to attain large timber dimensions, the results will no doubt be appreciably more favourable.

APPLICATION TO INDIA.

The system of raising two or three agricultural crops with forest seedlings would with very great advantage be adopted in the large stretches of more or less pure teak in the Central Provinces to replace the present coppice teak, deteriorated through centuries of Dahya and forest fires and abusive exploitation, by a new crop raised entirely from seed. The present degenerate crop attains a height of only 40 to 60 feet; a new seedling crop would certainly push up at least 15 feet higher and thus yield valuable sawing material, whereas now we hardly get anything better than poles and thick posts.

The forest growth being cleared and the soil prepared by the end of the hot weather, rice or Indian corn or Sesamum should be sown in the first succeeding rainy season. In the next year the agricultural crop should be only a cold weather one, so that at the commencement of the rains, the land being thoroughly ploughed up, teak seedlings just germinating may be planted out 6 feet apart in lines 12 feet apart, an intermediate line between two consecutive ones of teak being sown with some hardy, quick-growing, soil-improving, marketable auxiliary species. The object of the cold-weather field crop will be to protect the young seedlings from frost. In the third rains *Cajanus indicus* could then be sown, in order not only to keep down weeds during the rains, but also to serve as shelter against frost throughout the ensuing cold weather. The forest seedlings, now two years old and enjoying the full benefit of a soil cultivated for three years, will be ready to make a vigorous start upwards on the first fall of rain and get beyond the reach of weeds, probably almost closing over the ground by the beginning of the cold weather.

The above are the broad lines of work; the details could be easily arranged to suit local conditions. In any case the cost of the forest regeneration would be almost, if not entirely, covered by the sale-value of the agricultural produce, while the fellings would yield a considerable revenue and a new crop will have been created which will rapidly grow up into the most valuable timber. The present degenerate crop is quite incapable of making any improvement, preserve it as long as we may, and to keep it standing is merely to sink money without prospect of any return.

Indian Foresters will be interested to learn that it was here at Viernheim that our late distinguished Inspector General, Dr. Schlich, made his début as a Forest Officer nearly a third of a century ago.

IV.—BADEN AND THE BLACK FOREST.

A SPECIAL KIND OF GROUP TREATMENT.

The Grand Duchy of Baden, possessing an area of 5,823 square miles, is essentially a hilly country lying on the right bank of the Rhine from the lake of Constance to Mannheim and situated between parallels of North Latitude 47° 35′ and 49° 50′ and Meridians of East Longitude 7° 25′ and 9° 50′. Its length from North to South is about 190 miles; its breadth is very variable, being greatest in the south along the Rhine (90 miles) and less than 20 miles between Baden Baden and Carlsruhe. The greater part of the country is included in the region of the Black Forest, which forms the massive block of hills in the angle made by the course of the Rhine, which, after flowing almost east and west on leaving the lake of Constance, bends northwards at Basle. The highest point of the Black Forest is the Hornisgrinde (3,824 feet). The climate of the entire region is a cold one, hence conifers, chiefly silver fir, with spruce (introduced artificially), predominate.

The total area under forest in Baden is 1,360,672 acres or 36·5 per cent. of the superficies of the entire country. Of this area 53·3 per cent. consists of broad-leaved trees, 46·7 per cent. of conifers. In respect of ownership the forests are thus distributed :—

	Acres.			
Crown forests	11,809	or	0·9	per cent.
State "	227,992	"	16·7	"
Communal forests	621,358	"	45·7	"
Forests belonging to other Corporate bodies	47,604	"	3·5	"
Private forests	451,909	"	33·2	"

A peculiarity of forest law here is that the private proprietor cannot charge himself with the police of his forests, which is done for him by the State, a regulation which makes the protection of the public forests a much easier matter than in other countries.

The direction of forests is a branch of the Central Office of Domains and State Property (including mines), which is subordinate to the Ministry of the Interior for all police work in forests and mines, and to the Ministry of Finances for all other details of work.

The Forest Department is charged with the administration, police and working of the State Forests, with the police and working of the forests belonging to communes and other corporate bodies, and with the police of private forests. The police duties include the prosecution of offences. In consequence of performing the Forest Police of the entire State, the Department employs as many as 2,295 Forest Police guards, distributed as follows :—

State forests	303	or	13·2	per cent.
Communal forests	1,315	"	57·2	"
Forests of other Corporate bodies . .	63	"	2·8	"
Private forests	614	"	26·8	"

The Crown forests, as well as the grand ducal shooting grounds, are looked after by two special Oberförsters and some of the Oberförsters of the State Forest List, under the supervision of the *General Intendant* of the Civil List. But here also for police work the jurisdiction of the Ministry of the Interior comes in.

The Central Office of Domains is composed of a Director (not a forester) and 11 members, of whom 5 belong to the Forest Department (1 Geheimrath, 3 Oberforstraths and 1 Forstrath). The Geheimrath is chief of the Working-Plans Branch and also of the Bureau for forest research, in which latter he is assisted by an Oberforstrath (not one of the three mentioned before).

The State, Communal and Private forests and those belonging to other corporate bodies are divided, taken together, into 102 ranges, all of which are in charge of Oberförsters. Accordingly a range includes the following average area—

	Acres.
Of State forests	2,235
Of Communal forests	6,092
Of Forests belonging to other Corporate bodies	467
Of Private forests	4,430
Total average	13,224

With the two Oberförsters in charge of Crown forests and one attached to the Central Office of Domains, the total number of Oberförsters is 105. There are 60 apprentices waiting to be appointed, the most senior of whom qualified as long ago as 1884. Taking this circumstance into consideration with the fact that there are only 6 offices above that of Oberförster, the lot of the Baden forest officer is not a very brilliant one. Nevertheless they never fail to get more candidates than are required to recruit the service. One of the Oberförsters I met served with distinction throughout the war of 1870-71 as an officer in a cavalry regiment, but preferred an appointment in the forests to continuing in the army, in which he would by this time have been commanding a regiment.

The Baden Oberförsters enjoy even more independence than the Bavarian Forstmeisters for they are subject to next to no inspection and draw up their own working-plans in co-operation with the Geheimrath at the Central Office, who sends a Taxator or Junior officer, usually an apprentice, to do the enumeration surveys, etc.

Of all the German States Baden is the only one that has religiously adhered to natural regeneration, which it has seldom failed to obtain, owing to the long period it allows for regeneration, 30—40 years. The average yield per acre per annum for all forests exceeds 60 cubic feet in material and 12 shillings in money net. In a forest in the Murgthal, under a jardinage resembling the group method, the corresponding figures are 86 cubic feet and nearly 30 shillings. Baden also enjoys the signal credit of never having abandoned the beech as the forester's friend.

As Dr. Schlich has given in an Appendix to his Text-book on working-plans a complete description of the Herrenwies Range, I will say nothing here regarding the forest there, but give below in Borggreve's words Oberförster Schätzle's account of the treatment of conifer forests in the mountainous regions of Baden. Herr Schätzle is one of the ablest forest officers in Germany.

Taking first the more or less one-aged crops resulting from the system of uniform successive regeneration fellings, whatever their age, the stems to be first removed are those suffering from canker or other injuries, especially those belonging to the dominating portion of the leaf-canopy, as there is advantage in sparing what can afterwards be taken out in thinnings. Such removals embrace about one-tenth of the standing stock and make small openings in the leaf-canopy which never fail to have a favourable effect on the rate of growth. In crops 60—80 years old the openings are large enough for young seedlings to spring up under them; the fellings are not made with the object of producing such seedlings, but if these do come, they are by no means unwelcome.

In older crops from 80 to 90 years of age, however, the appearance of seedlings is always very desirable, and hence if the removal of the unsound trees alone does not open out the leaf-canopy enough for the purpose, others must also be taken out, the rules for thinnings being followed.

In this manner the way is opened for regeneration and thenceforward a fresh felling is made every ten years in order to maintain the new growth that has already appeared and to bring in more of it. In these regeneration fellings the first stems to be taken out are always those suffering from some injury; next those which have been overtopped, or are knotty or crooked, or have a spreading habit, and, lastly, the largest trees. Fine, straight, sound, flourishing trees must not be touched until 40—50 years after the appearance of the first seedlings. The new generation so constituted consists of stems from 1 to 50 years old and may be advanced enough to require being thinned simultaneously with the removal of the old trees still left over it.

Coming now to crops in which ages are mixed, these likewise are operated upon every ten years. Here also the first stems to go are the injured and unsound ones, then those which are overtopped or misshapen, and, lastly, those which have attained exploitable size. In such crops groups of more or less one age may be met with; from these nothing is taken out except injured and completely suppressed individuals so that the trees composing them may continue to grow up in complete leaf-canopy.

Should a crop contain some unusually large trees, the felling is split up into two operations, the first of which embraces only the large trees. The second, which follows 5 years later, then takes out, besides the large trees whose removal was still doubtful at the time of the first operation, those injured in that operation and those which are suppressed and no longer useful, and in addition all bad, unpromising advance growth. After every such cutting the pruning of the older stems, which is expedient and desirable in crops composed of trees of more or less one and the same size, is indispensable in those which present a true jardinage character. The advantages to be gained from the pruning are greater than the resulting disadvantages; without such pruning it would be impossible to leave fine young trees standing for any length of time without certain injury to the young growth below.

Where the young growth is still small, the pruning need not extend up to more than half the height of the stems to be operated upon; but if it is from 36 to 50 feet high, then must the branches of the overtopping trees be removed up to two-thirds of their height. Trees having an abundance of low branches are preferably pruned in more than one operation, as heavy pruning would throw them back very considerably; although the rate of growth would of course again become normal in another five years or so. In pure crops the stems of the future in the lower story are also pruned at the same time as the old trees.

The trees are usually felled in spring after the sap is up. All the summer through the logs lie in the forest and are brought on to the road-side in autumn. But when the felling is effected in summer, the clearing of the produce takes place during winter and spring. The clearing operations do not do much damage as the sliding and dragging paths are only about 100 years apart. After the coupe has been cleared after each felling, all blank spots are planted up.

It will be observed that the system just described is really the group method, differing only in minor details, as a consequence of difference of local conditions, from the system now so much generalised in Bavaria.

The best recommendation for the system is the fact that careful measurements in experimental plots have disclosed a rate of growth up to 200 cubic feet per acre per annum and that 66 per cent. of the produce obtained off 2,478 acres has been timber. The cost of planting up, pruning and keeping the growth clean is only 7·1 pence per acre per annum. The net money return per acre per annum fluctuates between 12 and 24 shillings, while in the so-called Murgschifferschaft's forest it has been as high as 28·3 shillings.

The regeneration of the silver fir, except by jardinage or some system which resembles jardinage, has been, to say the least, extremely unsatisfactory not only in Germany but everywhere in France, and the sooner this fact is acknowledged and the absurd prepossession in favour of the system of uniform successive fellings is given up, the better will it be for the very existence of the silver forests of Europe. The system followed in Baden and described above is based on the only correct principle to be followed in forestry, *viz.*, to do at each point of a crop only what the crop at that point requires and not what fits in with some theoretical symmetry of work, which regards the entire crop as something to be reduced to a uniform pattern.

WÜRTTEMBERG

AND

THE BLACK FOREST.

WÜRTTEMBERG WITH SPECIAL REFERENCE TO THE BLACK FOREST.

For reasons stated in my Diary I am unable to write at any length on the system of forestry pursued in this State, which lies wedged in between Baden on the West and Bavaria on the East, and stretches between parallels of Latitude 47° 30′ and 49° 35′ North and between meridians 8° 5′ and 10° 25′ of East Longitude. The following area statement requires no explanation :—

DISTRICT.		TOTAL FORESTS		COMPOSITION.		OWNERSHIP.				Remarks.
				Percentage of		Percentage of				
Name.	Acreage.	Acreage.	Percentage.	Broad-leaved	Conifer	Crown	State	Public corporations	Private	
				Forest.		Forest.				
Neckar . .	822,858	225,323	27·4							In respect to the area of the kingdom the percentage of the State forest area is 10.
Schwarzwald .	1,179,073	468,081	39·7							
Jagst . .	1,270,090	400,300	31·5							
Donau . .	1,547,560	388,534	25·1							
Totals .	4,820,187	1,482,237	30·7	40·5	59·5	0·3	32·4	32·2	35·1	

The Forest Department administers both the State forests and those of public corporations, but in the one case it is responsible to the Ministry of Finances, in the other to the Ministry of the Interior. The Crown forests are under the jurisdiction of the office of Crown Lands, but some of them are, under that authority, administered by officers of the Forest Department, who at the same time hold charge of ranges of State forest. The anomaly of the officers of a Department obeying three separate authorities is possible only owing to the limited area of the Kingdom, 7,532 square miles (the size of a middle class Native Indian State).

The Crown forests are constituted into five Ranges of an average area of 2,826 acres each.

The State forests and those belonging to public bodies are grouped together for the purpose of forming divisions and ranges, the numbers of which are respectively 16 and 172 and average area 59,863 and 5,569 acres. In the case of the State forests the higher control is exercised by a body directly under the Ministry of Finances at Stuttgart and composed of a *Präsident* or Chief Conservator and four Oberförstraths or Junior Conservators. For purposes of inspection the Divisions are thus allotted. The Chief Conservator looks after the Division in which Tübingen is situated, while his juniors supervise respectively

2,3,4, and 5 divisions respectively. The areas of these five conservatorial charges are respectively 27,119, 105,121, 73,085, 141,724, and 183,560 acres, distributed over respectively 9, 27, 31, 36 and 45 Ranges. The three middle ones, (second, third and fourth) have also attached to them the controlling of forests belonging to public corporate bodies to the extent of 50,713, 47,593 and 38,228 acres respectively, thus bringing up their total areas to 155,834, 120,678 and 179,952 acres respectively.

The forests belonging to public corporations are controlled by a council of seven officers, composed of the same *Präsident* as the State Forests Section, the three Oberforstraths already mentioned above and three Civil Officers. The three last inspect the forests which do not lie within the circles controlled by the three Oberforstraths.

The Ranges which contain no State forests (there are 24 such Ranges) are almost exclusively in charge of a lower class of official than Oberförsters, mostly belonging to the Subordinate service.

The establishments belonging to the State forests list are composed as follows:

SUPERIOR SERVICE.

1	*Präsident* or Senior Conservator .
4	*Oberforstraths* or Junior Conservators.
8	Forstmeisters bearing the title of *Forstraths* or Deputy Conservators.
8	,, or Senior Assistant Conservators with controlling charges.
154	*Oberförsters* or Junior Assistant Conservators.
18	Attached *Assistents* or Apprentices.
42	Unattached ,, ,, ,,

SUBORDINATE SERVICE.

8	Foresters.
486	Forest Guards.

A total strength of 729 officers and men for a Kingdom hardly equal to three of our ordinary Indian districts and containing a smaller area of forests than the majority of our Indian Forest Divisions! This is a stronger establishment even than that maintained by Saxony.

In the management of the State forests the chief stress is laid on the principle of producing what the country requires (designated "national exploitability" in my translation of Broilliard's *Aménagement des Forêts*). Accordingly all the refinements of Financial Exploitability are avoided.

Within the last 20 years Württemberg has had to yield to the tendency of shortening the rotations rendered necessary by the fall in the prices of large timber. Another reason for this step was to provide against the extensive ravages which used to be caused in old crops that had begun to clear themselves in consequence of having reached a certain limit of age. Accordingly, the rotation for silver fir has been reduced from 140 to 120 years and that for spruce from 120 to 100. That for beech has been fixed at 100 years, and where Scots' Pine forms the whole or part of the stock, the figure is made to vary between 80 and 100 years. The period in which regeneration must be accomplished has also been reduced to a maximum of 25 years and is often only 20 years. This reduction has not been favourable for the silver fir in the Black Forest; as the regeneration of this fir cannot be pushed on so fast, the spruce is rapidly driving it out, a result which is hastened by the almost universally adopted system of uniform successive fellings.

Half a century ago, before the present complete system of roads in the Black Forest was made, there was little demand except for large timber, and jardinage was the treatment applied, giving rise to those magnificent forests of silver fir of which we see now only traces, as in the Pfalzgrafenweiler Range. Then came a better system of communications and simultaneously with it the method of uniform successive fellings, which in Germany, as in France, was to be the universal panacea for all forest ills Since then regeneration has seldom been satisfactory and has had to be completed artificially. Silver fir yielding slow results and not lending itself to being introduced away from shelter, spruce has been the species used. With the present short period, the old crop must be cleared whether the regeneration is complete or not. Usually it is very incomplete and the soil overgrown with weeds, with the result that a larger and larger proportion of the felled area has to be put under spruce every year.

Spruce grows much more rapidly than silver fir and small billets are in large demand for the wood paper-pulp industry, and so far its extension has been attended only with favourable results But when the age at which the wind becomes dangerous arrives or invasions of insects begin their ravages, there will be a very different tale to tell. Even in the Reichenbach Range, which was shown to me as a specially successful example of regeneration, the spruce is rapidly supplanting the silver fir. In the best portions of silver fir reproduction, the young plants not having come up in close groups, are often too branchy to have much of a future before them.

These undesirable results have not escaped the local officers, and Oberförster Kienzle has adopted in his range (Baiersbronn) the group method with complete success. The planting of spruce costs 28 shillings an acre and is an outlay one would gladly avoid. Being pre-eminently shade-enduring, the silver fir is specially adapted for regeneration by the group method, which can be regulated to produce any degree of mixture of two firs.*

Another result following the abandonment of jardinage and the adoption of the system of uniform successive fellings has been that the beech has been found to become such a pest that war to the knife has been waged against it. This is most regrettable. A bad master, beech is a most excellent servant, and in order to keep it under subjection and utilise its services the only thing necessary is to adopt a proper method of treatment. As a return to jardinage is impossible, the only resource left is to generalise the application of the group method.

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* See Report on Forestry in Bavaria, pp. 84 *et seq.*, and Report on Forestry in Baden, p. 114.

The first thinning in silver fir forests is made at the age of 25—30 years, the next two thinnings at intervals of 10 years, and thereafter the operation is repeated every 15 years. The thinnings are made very light and the produce they furnish constitute only from one-twelfth to one-fifth of the total yield. They resemble very much the French *éclaircie par le haut.*

The average total yield in the Black Forest is about 78 cubic feet per acre per annum. In Pfalzgrafenweiler it is nearly 120 cubic feet.

In the Pfalzgrafenweiler Range I saw the system of floating which was, before the present good roads were made, the sole means of export possible from the Black Forest into the Rhine Valley. It is fully described in the printed Report made by Colonel (then Captain) Campbell Walker in 1871.

Before I conclude, it is necessary to say a few words regarding the subject of working-plans. Throughout the forests of the Kingdom the yield is regulated on the double basis of area and volume, each period being allotted its corresponding area, and the yield in volume estimated for the first two or three periods, although it is fixed only for the ensuing half-period of 10 years, at the end of which a revision has to be made. The yield of the regeneration fellings is fixed by volume, thinnings being prescribed by area During the 10-year interval between one revision and the next, an intermediate revision is made, comparing what has been cut with what ought to have been cut and prescribing the consequent changes required.

There is no separate working-plans branch as in Saxony. The Range Officers in consultation with the officers above them draw up the plan and revise them. For this purpose they are given the assistance of surveyors and young apprentices and candidates qualifying for the Departmental Examination The object of this arrangement is to interest in the execution of the plans the officers who are to carry them out. It has, however, the drawback of perpetuating *partis pris,* as officers are changed only at long intervals Conflict of minds and ideas is the surest way of arriving at the right thing wanted.

THE SIHLWALD, ZURICH, SWITZERLAND.

A MODEL COMMUNAL FOREST.

This is a forest of 2,720 acres belonging to the town of Zurich and situated in the valley of the Sihl about 9 miles to the south. As it lies in a different commune, the town of Zurich has to pay the usual taxes to that commune.

The elevation above the sea varies from 1,640 to 2,950 feet. The climate hence resembles that of the central and southern parts of the Black Forest. There were very heavy falls of snow in 1885, which broke 1,767,500 cubic feet of wood. The soil is the result of the decomposition of the underlying schists and shales and is generally of excellent quality. On the western face of the valley and to a slighter extent on the eastern face there are some slopes fit principally for Scots' Pine. The stock is, however, composed chiefly of beech, silver fir, spruce, ash, and scattered maples. A little larch has been planted.

The rotation is 90 years and the yield is regulated entirely by volume. The compartments are, however, large for the extent of the forest.

The regeneration is effected as far as possible naturally, the seed-felling being followed by a single secondary felling and then by the final felling. There is nearly always more or less abundant advance growth on the ground at the time of the seed-felling, so that the final felling succeeds only about 7 years after. Immediately after the felling blanks are filled up with transplants of spruce or pine, according to the soil. The forest has always been a mixed one and has consequently never been troubled with fungus epidemics or insect depredations.

A cleaning is made five years after the final regeneration felling, and the first thinning ten years later. The second thinning follows in ten years, and the subsequent ones are effected every 7—10 years.

The total annual yield averages, in round numbers, 353,000 cubic feet, or 130 cubic feet per acre per annum. The intermediate yield is to the final yield as 4 : 6. The net revenue is 33 shillings per acre per annum. Labour is dear, but, on the other hand, prices are high.

The average expenditure per acre per annum is as below :—

On account of Establishments . . .	10·6 *d.*	Includes 21·2*d.* paid in taxes to commune in which forest is situated.
„ „ Felling and Conversion . . .	77·7 „	
„ „ Transport	63·9 „	
„ „ Planting	10·6 „	
„ „ Roads and Tramways . . .	53·2 „	Nearly 21½ per cent. of total expenditure.
„ „ Buildings	31·9 „	
Total .	247·9 „	=£1-0-8.

This figure seems very high compared with the corresponding rates in Germany (5·1 and 4·6 shillings respectively in the Rohrbrunn and Rothenbuch Ranges of the Spessart, and 5·7 shillings in the

Hauptsmoorwald). But it is not really high, if allowance is made for peculiar organization of work in this forest to be now described.

The entire produce of the forest is sold only after complete conversion and at two depôts, one situated at the entrance to the forest next to the terminus of the Sihlwald Railway, the other opposite the other terminus of the same railway at Zurich itself. At the first depôt is a factory containing various wood-working machines driven by water-power supplied by the Sihl. Even handles for spades and other tools are turned by machinery. There are also two wood wool-making machines. Next to the machine shed is a yard for impregnating wood with sulphate of copper. The impregnation is often effected even in the forest on the coupe itself. Even firewood is cut to size and split by machinery at the factory, and then forced into strong iron hoops, to form bundles of a given size. The wood is delivered at the consumer's residence, bound in this manner, the hoops being brought away to be used over again. It may thus be safely said that with the exception of thin brushwood, which is of course bound up into faggots in the forest, all the wood undergoes conversion after being brought to the factory.

A 60-centimetre (23·62 in.) gauge tramway, with an average descending gradient of 6 in 100, runs along the entire length of the forest and has been in existence ever since 1876. A running metre of the double rail weighs 15 kilograms (30·31 pounds per yard), and a running yard of the way fully laid costs just under 35 pence. As the tramway constantly descends, no traction power is required for the loaded trucks. A single workman, manipulating the brakes, brings down a whole train of six or more trucks.

The coupes are connected with the tramway just described by means of wooden slides or shoots, and if they are a little distance off, connection between the end of the shoots and the tramway is effected with Décauville's portable railway made on the same gauge as the fixed way. Great skill is displayed in laying the portable rail sections, which are placed along the most difficult ground without any resort to earthwork. Depressions are filled up with some of the firewood billets and ravines spanned by temporary bridges formed with the logs. When all the rest of the wood has been transported, the rail sections are taken up one by one beginning at the end furthest away from the fixed tramway, and the wood used under them carried down in their turn. The photogravure opposite illustrates how the portable railway is laid.

As the transport and conversion operations require skilled labour, Forstmeister Meister, to whose resourcefulness and talent for organization are due the whole of the present arrangements and who has been in charge here for more than a quarter of a century, has established at his depôt a complete settlement of his workmen. He has built for them large houses divided into complete sets of apartments, for which a very moderate rent is charged. The work-people number about 300 with their families. As this number is not sufficient to make a shop a paying concern, supplies are brought in periodically from Zurich under the direction of the Forstmeister. Herr Meister has established a school and organised an accident fund and encourages Life Insurance.

Survey of India Offices, Calcutta, May 1897

[illegible] PORTABLE TRAMWAY, SIHLWALD, ZURICH

Photo etching

The settlement enjoys also the luxury of a post and telegraph office and also telephonic communication with Zurich. The Sihlwald is a favourite resort of the Zurich people in summer, but Herr Meister considers excursionists, when numerous, a danger to sylviculture, and he consequently permits only a single restaurant in his settlement. He would probably not have even this one, but his work-people require some place where they can refresh and recreate themselves occasionally in the evening.

The railway to the Sihlwald from Zurich is also due to Herr Meister. He advocated its construction for years in the interests of his forest, and he has now the satisfaction of controlling it as one of the Directors.

It is now easy to understand why the expenditure on conversion, transport, roads and buildings figures so high ; but it is far more than covered by the higher prices which are a consequence of the conversion of the produce of the forest and its delivery at the very doors of the consumers.

The Forest and Forest Settlement of the Sihlwald are well worth a visit by every Indian Forester, especially by those who have to manage forests for the wants of special stations like Naini Tal, Ranikhet, Darjeeling, Ootacamund, etc., and by those whose forests are in the vicinity of large centres of consumption.

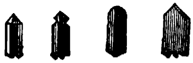
The greatest credit possible is due to Herr Meister for the results attained. He has achieved these in spite of the defective organisation of the Swiss Forest Department, which is very unfavourably affected by the cantonal system of Government. That he is a very remarkable man is shown by the fact that he is not only a distinguished forester, but is also commander of the military forces of his canton, which he moreover represents both in the Cantonal Council and in the Federal Council at Bern.

I append a printed price list for all major produce except firewood. It shows the variety of classes of the converted wood.

No.		Preis bei Abnahme von mindestens 25 Stück.
	I.—STIELE.	*Cts.*
1	**Wurfschaufelstiele,** geschnitten 1,50 *m* lang	60
2	„ gedämpft gebogen, 1,50 „ „	100
3	„ gerade, 1,50 „ „	50
4	**Pickelstiele,** 1 *m* lang, je nach Dicke	42—47
5	„ 1,10 „ „ „ „ „	47—52
6	**Kramphauenstiele** 1-1,10 „ „ „ „ „	60—70
7	„ fur Hauen mit Pickel, 1,10-1,40 „ „ „ „ „	70—90
8	**Zapinstiele**	90
9	**Steinschlagel-u. Vorschlaghammerstiele,** eckig u. oval 80 *cm* lg	30
10	„ „ „ „ 94 „ „	35—40
11	**Zweispitzstiele,** 60-62 *cm* lang	25
12	**Maurer- und Senkhammerstiele**	15—20
13	**Diverse Hammerstiele** 30-42 *cm* lang	15—20
14	„ „ geschweifte 50-55 „ „	25—35
15	**Axt- und Beilhalme,** gerade 40-90 „ „	20—45
16	„ „ geschweifte 40-90 „ „ „	30—55
17	**Spatenstiele,** mit Knopf oder Schwirbel	55—70
18	**Heugabelstiele,** gewöhnliche	36—38
19	„ gebogene	60—75
20	**Heurechenstiele,** tannene	33—36
21	„ eschene	38—41
22	„ ahorn	40—43
23	**Mistgabelstiele,**	55
24	**Karsthalme**	60
25	**Hauenstiele,** gewöhnliche	60
26	**Gartenhauelistiele**	30—40
27	**Gartenrechenstiele,** tannene und eschene	20—25
28	**Sensenworbe,** roh ausgeschnitten	40
29	**Sensenschwirbeln**	5
30	**Rechenhaupter,** 75-90 *cm* lang	10—15
31	**Wiecherstiele** tannene	15—25
32	**Speichen** von Eschen-, Ulmen- und Akazienholz	...
33	**Felgen**	...
	II.—RUNDE UND VIERKANTIGE STÄBE.	
34	**Einfache Rundstangen,** tannene 12-60 *mm* dick pro lfd. m.	6—50
35	„ „ eschene u. ahorn, 12-60 „ „ „ „	7—65
36	**Runde Messstangen,** beidseitig verjüngt	...
37	**Flaggenstangenmaterial**	...
38	**Schirmstäbe,** roh ausgearbeitet mit und ohne Griff	...
39	**Geschirrstabe**	...
40	**Tischfüsse,** roh ausgeschnitten	...
41	Entrindete und gedämpfte Tannäste für Umzäunung	...
42		...
43		...

No.	III.—HOLZWOLLE.	Schmale Faser. Fr.	Breite Faser. Fr.
	No. 1 . . per 100 Kilos	9.—	14. —
44	„ 2 . . in. Ballen v. ca 50 Kgs. „ 100 „	12 —	17. —
	„ 3 . . „ 100 „	16 —	26. —
	„ 4 Speziell fur Obstverpackung per $^1/_2$ Balle ca. 25 Kgs.		3.50
	„ $^1/_1$ „ „ 50 „		7.—
	„ 5 . . . . per 100 „		15 —

IV.—IMPRÄGNIRTE ARTIKEL.

No.		Tannen Fr.	Preis, cts. Buchen Fr.
	a. Boden- und Bruckenbelege		
45	**Bodenbelege fur Stallungen und andere gedeckte Raume.**		
	quadratisch abgekantete Klotze 10 *cm* hoch, ... per m^2	7. —	7. 50
	12 „ „ ... „	8. 40	9. —
	15 „ „ . „	10. 50	11. 25
46	**Bodenbelege für Strassenpflaster,** langlich viereckige 8 *cm* hoch, ... per m^2	5. 10—5. 60	6.—6 50
	10 „ „ ... „	6. 50—7. —	7.50
47	**Bruckenbeleg-Bohlen**	.	...
	b. Zaunmaterial.		
48	**Gartenpfosten,**		
	rund, 1,5-2 *m* lang 10-12 *cm* Durchmesser . .	1.—b 1.50	...
	kantig, 1 5-2 *m* lang 10-12 *cm* dick . . .	1.30—1.60	1 80—2.50
49	**Gespitzte Pfähle,** runde, mit abgedrehtem Kopf, und vierkantige	...	...
50	**Zaunlatten,** halbrund . . . . per lfd. Mtr.		28—32
50a	**Zaunhälblinge,** 1—2 *m* lang . . . . „ Stück		14—35
51	**Zaunlatten,** kantig . $^4/_5$—$^5/_{10}$ . . „ lfd Mtr.		25—40
52	**Staketen,** verschiedener Dimensionen 		
	c. Verschiedene Sortimente.		
53	**Baumstecken,** gespitzt, 2,80—3 *m* lang . . . per Stück		55—65
54	**Rebstickel,** gespitzt, 2,10 *m* und 2,40 *m*		...
55	**Rosenstecken,** 50 *cm* bis 1 *m* lang 18—24 *mm* Durchmesser		8—15
	„ 1 *m* bis 1,50 *m* lang 24—27 *mm* „		15—25
	„ über 1,50 *m* 30—36 *mm* „		28—35
56	**Spalierlatten,** verschiedener Dimensionen		...
57	**Rundstangen,** fur electrische Leitungen v. 6.5 *m* b. 15 *m* Lang		...
58			...
59			...
60	**Schnittwaaren,** v. 3 *mm* Dicke an in beliebigen Dimensionen		...

FORSTVERWALTUNG DER STADT ZÜRICH:

U. Meister, Forstmeister.

G. I. C. P. O.— No. 178 R. & A.—27-5-97,—600—J. N. D.

VIII—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

16th December 1896.—No 1090 260-6. F.—Mr B. B Osmaston, officiating Instructor at the Imperial Forest School, Dehra Dun, is granted privilege leave for three months, with effect from the 25th November 1896.

From the same date, Mr Osmaston reverted to the North-Western Provinces and Oudh Forest List.

16th December 1896.—No 1093 260-7 F.—On return from the furlough granted him in the notification of this Department No. 329 F, dated the 1st May 1896, Mr. A. F Gradon, Deputy Conservator of Forests, Burma, is re-appointed Instructor at the Imperial Forest School, Dehra Dun, with effect from the 27th November 1896.

2—Madras Gazette.

30th November 1896 —The following transfers are ordered :—

Ranger E. A. Monisse from South Malabar to Nilgiries. To join at once.

Ranger A G Van Haeften from Nilgiries to South Malabar.

2nd December 1896 —The Board of Revenue has granted one month's privilege leave under section 291 of the Civil Service Regulations, to Mr. G Hadfield, District Forest Officer, South Malabar Division, from or after the 25th November 1896

11th December 1896 — (1) N S Veerachulu, Forest Ranger, Ganjam District (on leave), is transferred to Kistna To join at the expiration of his leave

(2) K. Aswatham Naidu, Forest Ranger, Kistna District, is transferred to Kurnool To join on relief by Ranger N S Veeracharlu.

16th December 1896 —No. 1 —Mr. H A. Gass, District Forest Officer, South Coimbatore, is granted privilege leave for one month and twenty three days, under article 291 of the Civil Service Regulations, with effect from 4th January 1897.

23rd December 1896.—The following confirmations are ordered :—

E. A Monisse, sub *pro tem* Ranger, V Grade to Ranger, V Grade, *vice* Pierce, resigned from 4th December 1896.

K. Narayanasami Iyer, Deputy Ranger, I Grade, to be sub. *pro tem.* Ranger, V Grade, *vice* J. W. Ryan on other duty in Burma, with effect from 4th December 1896.

26th December, 1896 —M R. Ry. T. M. Nallasami Naidu Garu, Extra Assistant Conservator of Forests, transferred to Northern Circle, is posted to Kistna District to do duty under the District Forest, Officer.

3.—BOMBAY GAZETTE.

3rd December 1896.—No. 6370.—Mr. W. G. Betham, Deputy Conservator of Forests, delivered over charge of the Kolaba Division to Mr. A. C. Robinson, Extra Assistant Conservator of Forests, on the afternoon of the 20th November 1896.

7th December 1896.—No. 9886.—His Excellency the Governor in Council is pleased to make the following appointments with effect from the date of retirement of Mr. H. Mainwaring :—

Mr. W. A. Talbot to be Deputy Conservator of Forests, Second Grade.

Mr. S. Hornidge, Assoc. M. Inst C. E., to be Deputy Conservator of Forests, Third Grade.

Mr. L. O. S. Osmaston, to be Deputy Conservator of Forests, Fourth Grade.

Mr. G. R. Duxbury to be Assistant Conservator of Forests, First Grade.

16th December 1896.—No. 10280.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. T. R. D. Bell to be Divisional Forest Officer, Kánara.
Mr. G. K. Betham to be Divisional Forest Officer, Sind.
Mr. G. M. Ryan to be Divisional Forest Officer, Thána
Mr. W. R. Woodrow to be Divisional Forest Officer, Dhárwár

16th December 1896.—No. 5617.—Messrs. R. S. Fagan and L. S. Osmaston, Deputy Conservators of Forests, respectively delivered over and received charge of the Poona Forest Division on the 30th November 1896, before office hours.

No. 5618.—Messrs. T. B. Fry, Deputy Conservator of Forests, and R. S. Fagan, Deputy Conservator of Forests, respectively delivered and received charge of the office of the Divisional Forest Officer, Working Plans Central Circle, on the 30th November 1896, before noon.

24th December 1896.—No 6972.—Mr. Dattatraya Manjunath Bijoor, Extra Assistant Conservator of Forests, who was transferred in Government Resolution No. 10392 of the 18th December 1896, was relieved of his duties as Personal Assistant to, the Conservator of Forests, S. C., on 24th December 1896, during office hours.

25th December 1896.—No. 7003.—Messrs. W. R. Woodrow and T. R. D. Bell, Deputy Conservators of Forests, respectively delivered over and received charge of the Southern Division of Kanara on the afternoon of the 23rd December 1896.

4.—BENGAL GAZETTE.

5th December 1896.—No. 5022.—Mr. W. F. Lloyd, Assistant Conservator of Forests, 1st grade, and Officiating Deputy Conservator, 4th grade, is, on return from furlough, posted to the charge of the Direction Division, and appointed to be Personal Assistant to the Conservator of Forests, Bengal.

15th December 1896.—No. 5232.—Mr. H. H. Haines, F. C. H., Deputy Conservator of Forests, on special duty in connection with Working Plans, is re-transferred to the charge of the Jalpaiguri Division.

Mr. H. A. Farrington, Assistant Conservator of Forests, is, on being relieved of the Jalpaiguri Division, attached to that Division.

18th December 1896.—No. 5330.—In supersession of this Department Notification No. 3685 For., dated 12th September 1896, Mr. H. D. D. French, Deputy Conservator of Forests s, on return from furlough, posted to the charge of the Sonthal Parganas Forest Division, *vice* Mr. W. H. Lovegrove, Deputy Conservator of Forests, transferred to the North-Western Provinces.

21st December 1896.—No. 5391.—Mr. C. G. D. Fordyce, Deputy Conservator of Forests, 2nd grade, is, on return from furlough, posted to the charge of the Sundarbans Forest Division.

Mr. E. Trafford, Assistant Conservator of Forests, 1st Grade *(prov. sub)* and Officiating Deputy Conservator of Forests, 4th grade, on being relieved of the charge of the Sundarbans Division, will remain attached to that Division.

29th December 1896.—No. 6941A.—The following Forest Officers have passed in the subject or subjects noted against their names:—

No.	NAME.	Subject.
1	2	3
1	Mr. H. A. Farrington ...	Bengali by the higher standard.
2	„ W. F. Perree ...	Forest Law, and Hindustani by the higher standard.
3	„ H. H. Spencer ...	Hindustani by both standards.
4	„ R. G. A. Hannah ...	Land Revenue Systems, and Hindustani by the lower standard.
5	„ T. J. Pocock ...	Hindustani by the higher standard.

29th December 1896.—No. 5550.—Mr. H. A. Farrington, Assistant Conservator of Forests, 2nd grade, attached to the Jalpaiguri Forest Division, is transferred to the charge of the Buxa Forest Division, *vice* Mr. W. F. Perreé, Assistant Conservator of Forests, whose services are placed at the disposal of the Government of India.

5.—N.-W. P. AND OUDH GAZETTE.

2nd December 1896.—No. $\frac{8895}{\text{II }66,\text{ B}}$.—With effect from the 1st July 1896, the date on which an appointment of Assistant Conservator of Forests, 2nd grade, was transferred from the Imperial to the Provincial Forest Service:—

Babu Raghu Nath Pathak, Extra Assistant Conservator of Forests, from the 3rd to the 2nd grade;

Mr. Keshva Nand, Extra Assistant Conservator of Forests, from the 4th to the 3rd grade.

No. $\frac{3896}{II\ 665\ B}$—Babu Nand Mal, Forest Ranger, 3rd grade, in charge of the Todgarh Range, Ajmere, to be Extra Assistant Conservator of Forests, 4th grade, and to be attached to the Bahraich Division of the Oudh Forest Circle, North Western Provinces and Oudh

3rd December 1896—No $\frac{3936}{II\ \text{[illegible]}\ C}$—Mr. A P Grenfell, Assistant Conservator of Forests, lately in charge of the Dehra Dun Divison of the School Forest Circle, furlough on medical certificate, partly in and partly out of India, for one year with effect from the 13th October 1896

12th December 1896—No. $\frac{4017}{II\ 233\ C}$—Mr Keshva Nand, Extra Assistant Conservator of Forests, attached to the Working Plans Branch of the Direction Division, Oudh Forest Circle, is seconded for service in the Tehri State

16th December 1896—No $\frac{4118}{II\ 535\ B}$—Mr W. H. Lovegrove, Deputy Conservator of Forests, whose services have been placed temporarily at the disposal of this Government, to the charge of the Dehra Dun Division of the School Forest Circle

22nd December 1896—No $\frac{4163}{II\ \text{[illegible]}\ B}$—Pandit Sada Nand Gairola, Extra Assistant Conservator of Forests, on being relieved by Mr W H Lovegrove, from the Dehra Dun to the Jaunsar Division of the School Forest Circle for duty in connection with the Working Plans

6.—PUNJAB GAZETTE.

1st December 1896—No $\frac{542}{A\ L\ No\ 36}$—On return from the furlough granted him in Punjab Government Notifications No. $\frac{294}{A\ L\ No\ 11}$, dated 3rd May 1895, and No $\frac{432}{A\ L\ No\ 26}$, dated 18th September 1896, Mr A L McIntire Deputy Conservator of Forests reported his arrival at Bombay on the 20th October, and at Lahore on the 3rd November 1896, and is attached to the Direction Division from the same date.

2nd December 1896—No. $\frac{516}{A\ L\ No\ 37}$.—On return from the furlough ganted him in Punjab Government Notification No $\frac{93}{A\ L\ No\ 6}$ dated 1st February 1895, Mr R J P Pinder, Deputy Conservator of Forests, reported his arrival at Bombay on the 20th October, and at Lahore on the forenoon of the 2nd November 1896, and is attached to the Direction Division from the same date

9th December 1896.—No $\frac{568}{A\ L\ No\ 38}$—In Notification No $\frac{542}{A\ L\ No\ 39}$, dated 1st December, *for* "20th October" *read* "afternoon of 31st October."

23rd December 1896—No. $\frac{586}{A\ L\ No\ 83}$—On return from the privilege leave granted to him in *Punjab Government Gazette* Notification No $\frac{469}{A\ L\ No\ 34}$, dated 2nd November 1896, Mr. B. O. Coventry, Assistant Conservator of Forests, took over charge of the Lahore Forest Division on the forenoon of the 16th December 1896, relieving Khan Bahadur Munshi Fazal Din, Extra Assistant Conservator of Forests, who remains attached to the Division until further orders.

7.—CENTRAL PROVINCES GAZETTE.

3rd December 1896 —No 4828 —With reference to Order No. 4327, dated the 12th November 1896, Messrs J J Hobday, Extra Assistant Conservator of Forests, and C O Hanson, Officiating Deputy Conservator of Forests, respectively made over and assumed charge of the Sambalpur Forest Division on the afternoon of the 2nd idem

3rd December 1896 —No 4829 —With reference to Order No. 4328, dated the 12th November 1896 Mr Ramchandar Rao Krishna, Extra Assistant Conservator of Forests, and Mr J J Hobday, Extra Assistant Conservator of Forests, respectively made over and assumed charge of the Chhindwara Forest Division on the forenoon of the 16th idem.

3rd December 1896 —No 4831 —On return from the two years' furlough granted him by Order No 3759 dated the 27th August 1895' Mr. W. King, Deputy Conservator of Forests, is posted to the charge of the Damoh Forest Division

3rd December 1896 —No 4832 —On being relieved by Mr W. King, Deputy Conservator of Forests, of the charge of the Damoh Forest Division, Mr. R. C Thompson, Extra Assistant Conservator of Forests, will remain attached to that Division until further orders

15th December 1896 —No 4974 —Mr L. Gisborne-Smith, Deputy Conservator of Forests, Central Provinces, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of the leave granted him by Orders Nos 1457 and 4325, dated respectively the 9th April and the 12th November 1896

21st December 1896 —No 5035 —Mr D O. Witt Assistant Conservator of Forests, appointed by Her Majesty's Secretary of State for India to the Indian Forest Service, reported his arrival at Bombay, on the afternoon of the 15th November 1896, and was posted to the Mandla Forest Division as Working Plans Assistant

Mr. Witt assumed charge of his duties at Mandla on the forenoon of the 30th idem.

23rd December 1896.—No. 5049 —Mr. M Muttannah, Extra Deputy Conservator of Forests, returned from the privilege leave granted him by Order No. 3125, dated the 13th August 1896, and resumed charge of the Nimar Forest Division from Mr. H E Bartlett, Assistant Conservator of Forests, on the afternoon of the 3rd December 1896.

23rd December 1896 —No 5063 —On being relieved by Mr. M. Muttannah, Extra Deputy Conservator of Forests, of the charge of the Nimar Forest Division, Mr H. E. Bartlett, Assistant Conservator of Forests, will remain attached to the Division as Working Plans Assistant.

23rd December 1896 —No. 5067.—On return from the furlough granted him by Orders Nos 1457 and 4325, dated respectively the 9th and the 12th November 1896, Mr. L. Gisborne Smith, Deputy Conservator of Forests, is posted to the charge of the Sambalpur Forest Division.

23rd December 1896 —No 5068 —On being relieved by Mr L Gisborne Smith, Deputy Conservator of Forests, of the charge of the Sambalpur Forest Division, Mr. C. O Hanson, Officiating Deputy Conservator of Forests, will be attached temporarily to the Direction Division.

31st December 1896 —No. 5138 —With reference to Order No. 4329, dated the 12th ultimo, Mr. Ramchandra Krishna, Extra-Assistant

Conservator of Forests, assumed charge of the Wardha Sub-Division on the forenoon of the 7th instant.

8.—BURMA GAZETTE.

1st December 1896.—No. 524.—The leave on urgent private affairs for six months granted to Mr. J. Messer, Deputy Conservator of Forests, has been commuted by Her Majesty's Secretary of State for India to one year's furlough on medical certificate.

1st December 1896 —No. 525.—On the return from privilege leave of Mr. J. Copeland, Deputy Conservator of Forests, Mr. S. Carr, Assistant Conservator of Forests, is transferred from Mandalay to the charge of the Pyinmana Working Plans Division.

1st December 1896.—No. 24.—With reference to notification No. 493, dated the 12th November 1896, Mr. F. J. Branthwaite, Deputy Conservator of Forests, made over, and Mr. A. M, Burn-Murdoch, Deputy Conservator of Forests, received, charge of the Working-Plans Division on the afternoon of the 27th November 1896.

1st December 1896.—No. 25.—With reference to Notification No. 20, dated the 14th ultimo, Mr. S. A. Wood, Forest Ranger, reported his arrival at Henzada on the afternoon of the 17th ultimo and assumed charge of the Myanaung subdivision on the forenoon of 22nd ultimo.

4th December 1896.—No 535.—Mr. George Eaton Stannard Cubitt, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator, 2nd grade, reported his arrival in Rangoon on the 5th December 1896, before noon.

Mr. Cubitt is posted to the head-quarters of the Prome Forest division, Pegu Forest Circle.

4th December 1896.—No. 536 —Mr. George Kenyon Parker, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator, 2nd grade, reported his arrival in Rangoon on the 4th December 1896, before noon.

Mr. Parker is posted to the head-quarters of the Upper Chindwin Forest division, Western Forest Circle, Upper Burma.

4th December 1896.—No. 22.—Mr. J. Copeland, Deputy Conservator of Forests, reported his return from the three months and 15 days' privilege leave granted him in Revenue Department Notification No. 363 (Forests), dated the 14th August 1896, and resumed charge of the Mandalay Forest division from Mr. S. Carr, officiating Deputy Conservator of Forests, on the forenoon of the 3rd instant.

5th December 1896.—No. 19.—With reference to Revenue Department Notification No. 494, dated the 12th November 1896, Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, made over, and Mr. H. B. Ward, Deputy Conservstor of Forests, received charge of the Rangoon Forest Division on the afternoon of the 30th November 1896.

10th December 1896.—No. 26.—Mr. F. Ryan, Extra Assistant Conservator of Forests, was on special duty in the Kado division, Tenasserim Circle, from the 9th to the 21st September 1896.

11th December 1896.—No. 23.—Mr. S. Carr, officiating Deputy Conservator of Forests, assumed charge of the Working Plans Division on the forenoon of the 3rd instant, in accordance with Revenue Department Notification No. 525 (Forests), dated the 1st December 1896.

14th December 1896 —No 24 —Mr. C S Rogers, Extra Assistant Conservator of Forests, reported his return from the three months and 15 days' privilege leave granted him in Revenue Department Notification No 337 (Forests), dated the 5th August 1896, and resumed charge of the Môngmit subdivision (Ruby Mines division) from Mr E. B. Powell, Extra Assistant Conservator of Forests, on the forenoon of the 30th November 1896.

15th December 1896 —No 25 —Mr C A. B Anderson, Extra Assistant Conservator of Forests, reported his return from the four months' leave on medical certificate granted to him in Revenue Department Notification No 446 (Forests) on the forenoon of the 4th instant, and received charge of the Shwegu subdivision from the Deputy Conservator of Forests, Bhamo division, on the forenoon of the 5th instant.

15th December 1896 —No 219 —At the departmental examination held at Rangoon, Myingyan, Meiktila, Mandalay and Monywa, on the 2nd and 3rd November 1896, the following Forest officers passed in the subjects specified below, according to the standard prescribed for the examination of Forest officers :—

Law.

Mr. A H M. Lawson, Assistant Conservator of Forests.
Mr A E. Ross, Assistant Conservator of Forests.
Mr J W. Ryan, Extra Assistant Conservator of Forests.
Mr. S A. Wood, Forest Ranger
Mr. G. T Wrafter, Forest Ranger.

Revenue

Mr. C B Smales, Assistant Conservator of Forests.
Mr A E Ross, Assistant Conservator of Forests
Mr J W Ryan, Extra Assistant Conservator of Forests.
Mr. F. W. Forster, Forest Ranger.
Mr G. T. Wrafter, Forest Ranger

Procedure and Accounts

Mr. A. H. M. Lawson, Assistant Conservator of Forests.
Mr J W. Ryan, Extra Assistant Conservator of Forests.
Mr. B P Kelly Forest Ranger
Mr S. A. Wood, Forest Ranger.
Mr. J L Heffernan, Forest Ranger.
Mr G T Wrafter, Forest Ranger

19th December 1896 —No 26 —With reference to Revenue Department Notification No 347 (Forests), dated the 5th October 1896, Mr. W. A. Hearsey, Extra Assistant Conservator of Forests, reported his return from the three months' privilege leave granted him in Revenue Department Notification No. 359 (Forests), dated the 13th August 1896, and received charge of the Mogôk subdivision, Ruby Mines division, from Mr. E. B. Powell, Extra Assistant Conservator of Forests, on the forenoon of the 10th instant.

9.—ASSAM GAZETTE.

10th December 1896 —No. 8067G.—Mr. J. C. Carroll, Assistant Conservator of Forests, who has been appointed by Her Majesty's Secretary of State to the Forest Department in Assam, having reported his arrival in India, is attached to the Goalpara Forest Division.

18th December 1896.—No. 8266G.—On the report of the Central Examination Committee, the Chief Commissioner directs the publication, for general information, of the results of the Half-yearly Examination of Assistant Commissioners Extra Assistant Commissioners, and other Officers held on the 9th, 10th, 11th, 12th, and 13th November 1896.

Name.	Subjects taken by the candidates		Subjects in which passed		Compulsory subjects which still required to pass	
	Higher Standard	Lower Standard	Higher Standard	Lower Standard	Higher Standard	Lower Standard
Assistant Conservator of Forests						
Mr A. R Dicks	Land Revenue Forest Law Procedure & Accounts		Land Revenue Forest Law Procedure & Accounts		Bengali	Bengali

10.—HYDERABAD RESIDENCY GAZETTE.

7th December 1896.—No 372.—Mr. R S Hole, Assistant Conservator of Forests, having reported his arrival at Amraoti on the afternoon of the 18th November 1896, is attached to the Direction Forest Division with effect from that date.

11.—MYSORE GAZETTE

1st December 1896.—No 4945—*Ft F* 91 95.—The leave on medical certificate granted to Mr B Srinivasa Rao, Assistant Conservator of Forests, Shikarpur Forest sub division, in Notification No 4107—Ft F. 91-95, dated 1st November 1896, is hereby extended by three months, at the end of which period he will report himself to the head-quarter office of the Conservator of Forests for orders

2 Mr J J Monteiro, Extra Assistant Conservator of Forests and Mr M. Srinivasa Rao, Ranger, 2nd Grade, will continue to act as Assistant Conservator and Extra Assistant Conservator of Forests, respectively, during the absence of Mr B Srinivasa Rao on leave or until further orders

5th December 1896.—No 5120—*Ft F* 92-95.—Mr. T Abdul Karim, Deputy Conservator of Forests, Mysore district, having availed himself of the two months and seven days' privilege leave granted to him in Notification No 2338.—Ft F 90 95, dated 1st September 1896, from the afternoon of the 8th September 1896, and returned to duty on the afternoon of the 12th November 1896, the unexpired portion of the leave, *viz* three days, is hereby cancelled

5th December 1896.—No 5120.—*Ft F*. 92-95.—Mr Y Sitaramaiya, Assistant Conservator of Forests, having availed himself of the two months ond sixteen days' privilege leave granted to him in Notification No 10367—Ft F 92-95, dated 29th May 1896, from the 7th June 1896, and returned to duty on the forenoon of the 21st August 1896, the unexpired portion of the leaves, *viz.*, two days, is hereby cancelled.

19th December 1896.—No. 5606.—*Ft F.* 27-95.—Mr. H. Srinivasa Rao, who in Government Notification No. 944—Ft. F. 27-95, dated 27th July 1896, was appointed to act as Sub-Assistant Conservator of Forests, will continue to act as such *sub. pro tem.*, *vice* Mr. M.G. Rama Rao, Acting Assistant Conservator, 3rd class, or until further orders.

19th December 1896.—No. 5609.—*Ft. F.* 62-95.—Under Article 188 of the Mysore Service Regulutions, Mr. M. G. Rama Rao, B. A., Officiating Assistant Conservator of Forests, Kakankote Range, Mysore district, is granted privilege leave of absence for fifteen days with effect from the 15th December 1896, or such other date as he may avail himself of the same.

23rd December 1896.—No. 5690.—*Ft. F.* 93-95.—The extraordinary leave without allowances for one year granted to Mr. C. E. M. Russell, Deputy Conservator of Forests, Kadur district, in Notification No. 5741—Ft. 380, dated the 29th December 1895, is hereby extended by another year.

25th December 1896.—No. 5767.—*Ft F.* 27-95—Mr. P. E. Benson, Sub-Assistant Conservator of Fotests, who was temporarily posted to the Tumkur district in Government Notification No. 11835—Ft. F. 1-96, dated 1st July 1896, is transferred to the Shimoga district for duty under the immediate orders of the District Forest Officer.

VIII--EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

7th January 1897 —No 14—124 25-F —The undermentioned officers, who have been appointed by Her Majesty's Secretary of State to the Forest Department of India are appointed to be Assistant Conservators of the 2nd grade with effect from the dates specified opposite their names and are posted to the provinces noted below —

Mr R S Hole Central Provinces 16th November, 1896

Mr D O Witt Central Provinces 16th November 1896

Mr F F R Channer, North-Western Provinces and Oudh, 16th November, 1896

Mr W A R Doxit North-Western Provinces and Oudh, 16th November 1896

Mr G E S Cubitt Burma 4th December 1896

Mr G K Parker, Burma 4th December 1896

Mr T H Monteath Bengal 10th December 1896

Mr J C Carroll Assam 26th November 1896

12th January 1896 —No 30 F —28 2 —On return from the privilege leave granted him in the notification of this Department No 1043 F —226 5 dated the 26th November last Mr F B Dickinson, Conservator of Forests, resumed charge of the Pegu Circle in Lower Burma from Mr. G F Prevost Officiating Conservator of the Tenasserim Circle, with effect from the 4th instant

15th January 1897 —No 51 F —24-3 —The following promotions are ordered in consequence of the retirement from the service of Mr. R H E Thompson Conservator of Forests, 2nd Grade, with effect from the 8th December 1896 —

(i) Mr. P J Carter Conservator, 3rd grade, Burma (on furlough), to the 2nd grade

(ii) Mr C. F Elliot, Officiating Conservator, 3rd grade, Punjab, is confirmed in that grade, and will officiate in the 2nd grade until further orders

2.—MADRAS GAZETTE

4th January 1897 —*Appointment* —K S Krishnamchari, Acting Ranger 5th Grade to be Ranger 5th Grade, from 1st January 1897.

Transfer —N Swaminatha Iyer, Forest Ranger, Anantapur District, is transferred to Godavari District

5th January 1897 —No. 10 —

No	Name of officer	Present grade	Grade to which promoted	Nature of promotion	Remarks showing cause of vacancy, &c.
1	Mr. S Cox	Assistant Conservator of Forests, 1st grade	Deputy Conservator of Forests, 4th Grade	Acting	During the absence of Mr C E Brasier on furlough, or until further orders The acting appointment to take effect from the 15th July 96.
2	Mr T P. Peake	Deputy Conservator of Forests 3rd grade	Deputy Conservator of Forests, 2nd Grade	Do	During the absence of Mr H J A Porter on furlough or until further orders
3	Mr C DuPré Thornton	Deputy Conservator of Forests, 4th grade	Deputy Conservator of Forests, 3 d Grade	Do	
4	Mr H F A Wood	Assistant Conservator of Forests 1st Grade	Deputy Conservator of Forests 4th Grade	Do	

11th January 1897 —

No	Name of officer	District	Nature of charge	Remarks
1	Mr C E C Fischer, Assistant Conservator of Forests 2nd Grade	Kurnool		To do duty under the supervision of the District Forest Officer.

15th January 1897 —No 30 —The privilege leave for one month granted to Mr G Hadfield District Forest Officer, South Malabar, is commuted into furlough without Medical certificate for two years, under article 840 (*b*) of the Civil Service Regulations

16*th January* 1897.—No 31 The special leave for six months granted to Mr R McIntosh, Deputy Conservator of Forests, 4th Grade, in Notification No 355 published at page 906 of Part I of the *Fort St. George Gazette*, dated 28th July 1896 has been commuted to leave on Medical certificate and extended to eight months under articles 264 and 840 (*a*) of the Civil Service Regulations

11*th January*, 1896 —*Leave*—To N Balajee Singh, Rangee Nellore District, for three months, in continuation of the leave notified in page 1430, Part II of the *Fort St George Gazette*, dated 1st December 1826, under article 369 of the Civil Service Regulations

14*th January* 1897 - Sub Assistant Conservator Mr C P. Howell, temporarily transferred from South Canara to North Coimbatore

14*th January* 1897.—No 32 —Messrs J W Cherry and C. E. Brasier of the Madras Forest Department, have each been granted by the Right Honourable the Secretary of State for India an extension of six months' furlough in continuation of the leave notified as notifications

Nos. 452 and 120) at pages 967 and 361 of Part I of the *Fort St George Gazette* dated 27th August 1895 and 17th March 1896, respectively

18th January 1897 —No 33 —

No.	Name of officer.	District	Nature of charge	REMARKS
1	Mr H F A Wood Assistant Conservator of Forests 1st Grade	Cuddapah	Acting District Forest Officer	During the absence of Mr Foulkes on other duty
2	Mr C J Woutersz, Extra Assistant Conservator of Forests, 3rd grade	South Coimbatore	Do .	During the absence of Mr Cass or until further orders

25th January 1897.—*Leave*.—One month's privilege leave on medical certificate is granted to Mr R O'Hara, Forest Ranger, Godavari District from the 9th January 1897

29th January—*Leave*—To A P Ramachandra Mudaliar, 5th grade North Arcot District for two months under article 291 of the Civil Service Regulations from 7th December 1896

3—BOMBAY GAZETTE.

20th January 1897—No 7062—Messrs G K Betham and W R Woodrow Deputy Conservators of Forests respectively delivered over and received charge of the Dharwar Forest Division on the forenoon of the 21st December 1896

4th January 1897—No 2486 -In accordance with Government Resolution No 8885 dated 10th November 1896 sanctioning three Forest Divisions for the Thana District Mr A G Edie, I F S, took charge of North Thana Division, and Mr J. Dodgson, I F. S, of the Central and South Thana Division (pending the arrival of Mr G M. Ryan) on the 22nd December 1896, in the afternoon

No. 2487—Mr T R D Bell I F S, handed over charge of the Working Plans Division on the 21st December 1896, in the afternoon.

5th January 1897—No 77—His Excellency the Governor in Council is pleased to appoint Mr G. P. Millett, on return to duty, to be Divisional Forest Officer, Working Plans, Northern Circle.

11th January 1897—No 7230—Mr H Mainwaring, Deputy Conservator of Forests, delivered over and Mr. V R. Kelkar, Deputy Collector, received charge of the Bijapur Division on the forenooon of the 4th January 1897.

12th January 1897.—No. 297.—Mr G. P. Millett, Deputy Conservator of Forests, Fourth grade, has been allowed by Her Majesty's Secretary of State for India to return to duty,

No. 251 Messrs J Dodgson Divisional Forest Officer, West Thana and A G Edie, Divisional Forest Officer, East Thana passed an examination in Marathi according to the Lower Standard on the 5th January 1897.

Mr. D A. Thomson, Assistant Conservator of Forests Northern Division Kanara passed an examination in Kanarese according to the Lower Standard on the 5th January 1897

14th January 1897.—No 2618 — Mr J. Dodgson, I. F S., delivered over and Mr G M. Ryan I. F S, received charge of the South Thána Division on the afternoon of the 8th January 1897

14th January 1897 —No 2619 —Mr. V. P. Ribeiro, L C. E., Extra Assistant Conservator of Forests, Third grade, was relieved of his duties in this Circle on the afternoon of the 9th January 1897, in order to proceed to Bijápur, as per Government Resolution No. 10392, dated 18th ultimo.

No. 2620.—Mr. S B Randé, L. C. E, Extra Assistant Conservator of Forests Fourth grade, delivered over and Mr D M Bijur, Extra Assistant Conservator of Forests, Third grade, received charge of the North Thána Sub-divisional office on the forenoon of the 14th of January 1897,

19th January 1897 —No 7414.—Mr V P. Ribeiro, Extra Assistant Conservator of Forests, received charge of the Bijápur Division from Rao Bahádur V R. Kelkar, District Deputy Collector, Bijápur, on the forenoon of the 14th January 1897.

23rd January 1897 —No 575 —His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. L S. Osmaston to be Deputy Conservator of Forests, Fourth grade, from the date of the vacancy caused by Mr. Gleadow's transfer from the Bombay Service, and Mr G R. Duxbury to be First grade Assistant Conservator of Forests vice Mr. Osmaston.

From the date of Mr Mainwaring's retirement. Mr O. H L Napier to be Fourth grade Deputy Conservator of Forests and Mr W. E Copleston to be First grade Assistant Conservator of Forests.

26th January 1897 —No 640.—Mr. Shesho Manju. Extra Assistant Conservator of Forests, Third grade, is allowed furlough for four months and nineteen days with effect from 1st December 1896

No 659 — His Excellency the Governor in Council is pleased to appoint Mr. Ganpat Jayavant Rege to act as Extra Assistant Conservator of Forests, Fourth grade, vice Mr. Shesho Manju on furlough and to be under the orders of the Conservator of Forests, Southern Circle.

No 2782.—Mr G P. Millett, I F. S., having returned from furlough, took over charge of the Working Plans Division from undersigned on the 26th instant in the forenoon

No. 7777 —In accordance with Government Resolution No 10830, dated 17th December 1896, Mr. T. R. D. Bell, Deputy Conservator of Forests, posted to the new Western Division of Kanara, handed over charge of the Sirsi and Siddapur Ranges to Mr Haselden, Divisional Forest Officer, of the new Southern Division of Kanara, and received from him the charge of the Ankola Range, on the 16th January 1897

Mr Bell also received charge of the Karwar Range, from E. G. Oliver, Divisional Forest Officer, Northern Division of Kanara, on the same date.

4 —BENGAL GAZETTE.

15th January 1897 —No 214 —The following reversions and promotions are ordered among the Officers on the Bengal List of the Imperial Forest Service, with effect from the 1st December 1896, consequent on the return to duty from furlough of Mr H D D French and the transfer to the North-Western Provinces and Oudh of Mr W H Lovegrove, Deputy Conservator of Forests, 4th grade provisional —

Mr H D D French, Deputy Conservator of Forests of the 4th grade, to officiate in the 3rd grade of Deputy Conservators

Mr C. G Rogers, F C H, Deputy Conservator of Forests of the 4th grade, officiating in the 3rd grade (on deputation to the Imperial Forest School) to revert to the 4th grade of Deputy Conservators

Mr H H Haines F C H Deputy Conservator of Forests of the 4th grade officiating in the 3rd grade, to revert to the 4th grade of Deputy Conservators

Mr E P Stebbing, Assistant Conservator of Forests 2nd grade, and Officiating Deputy Conservator of Forests 4th grade to be an Assistant Conservator, 1st grade sub *pro tem*, and to continue to officiate in the 4th grade of Deputy Conservators

15th January 1897 —No 215 —Consequent on his return to duty from furlough on the 12th December 1896 Mr W F Lloyd Assistant Conservator of Forests 1st grade, is promoted to be Deputy Conservator of Forests 4th grade sub *pro tem*, *vice* Mr W H Lovegrove transferred to the North-Western Provinces

Mr E P Stebbing, Assistant Conservator of Forests 1st grade, sub. *pro tem*, and Officiating Deputy Conservator 4th grade, reverts to Assistant Conservator, 1st grade sub *pro tem*

19th January 1897 —No 247 —Mr J W A Grieve, Assistant Conservator of Forests, 2nd grade, is promoted to officiate in the 1st grade of Assistant Conservators with effect from 4th May 1896, and in the 4th grade of Deputy Conservators of Forests, from 4th August 1896 to 4th November 1896 From the latter date Mr Grieve will revert to officiating 1st grade Assistant Conservator

5 —N.-W. P. AND OUDH GAZETTE

4th January 1897 —No. $\frac{28}{\text{II 666B}}$—With effect from the 25th November 1896 the date on which Mr B B Osmaston Deputy Conservator of Forests, 4th grade reverted to these Provinces .—

Mr. P H. Clutterbuck, Deputy Conservator of Forests, 4th grade, provisionally substantive, to revert as Assistant Conservator of Forests, 1st grade, continuing to officiate as Deputy Conservator, 4th grade.

Mr J C Tulloch, Assistant Conservator of Forests, 1st grade, provisionally substantive, to revert to the 2nd grade, continuing to officiate as Deputy Conservator, 4th grade.

4th January 1897 —No $\frac{26}{\text{II } 86\text{A}}$—The following temporary promotions and reversions are notified for general information :—

Entry No	With effect from	Consequent on	Name.	From	To
1	13th Octr 1896	Mr A P Grenfell s departure on leave.	Mr H G Billson.	Offg Asst Cons of Forests, 1st grade	Offg Dy Cons. o Forests, 4th graf de
2	23rd Octr 1896	Mr F A Leete's return from privilege leave	Mr H G Billson	Offg Dy Cons of Forests, 4th grade.	Offg Asst Cons of Forests, 1st grade

12th January 1897 —No $\frac{22}{\text{VII } 455\text{B } 10}$—The Hon'ble the Lieutenant Governor and Chief Commissioner is pleased to declare the undermentioned gentlemen, other than Tahsildars and candidates for Tahsildarships, with regard to whom a separate notification will be issued, to have passed the Departmental Examination for junior officers held on 19th October 1896 and following days, in the subjects specified below —

IV. Forest Officers
Land Revenue systems
By the Higher Standard.
Mr R. C Milward
Procedure and Accounts.
Mr R C Milward.
Vernacular
Mr E L Haslett

6.—PUNJAB GAZETTE.

8th January 1897 —No $\frac{8}{A\ L\ No\ 1}$—*Notification* —The following changes have taken place in the list of Forest Officers on the Associated Provinces with effect from the dates specified against each :—

Name	Present Grade	Grade to which promoted or reverted	With effect from	REMARKS.
Mr L Gisborne Smith	Dy Cons , 3rd Grade	Offg Dy Cons , 2nd Grade	13th December 1896	Consequent on the return of Mr Gisborne Smith from furlough
Mr A. L McIntire	Offg Dy Cons , 2nd Grade	Dy Cons., 3rd Grade	Ditto	
Mr. C. P Fisher	Offg Deputy Cons , 3rd grade	Deputy Cons , 4th grade	Ditto	
Mr. Linnell –	Offg Deputy Cons 4rd grade.	Assistant Conservator, 1st grade	Ditto	
Mr G. F Taylor,	Offg Dy Cons , 2nd grade	Dy Cons , 3rd grade	21st Decr 1896	Consequent on the return of Mr. King from furlough
Mr. G. S. Hart,	Offg Dy Cons , 3rd grade	Dy. Cons , 4th grade	Ditto	
Mr R M Williamson	Offg Dy Cons., 4th grade	Asst Cons , 1st grade	Ditto	

11*th January* 1897 —No $\frac{12}{A\ L\ No\ 2}$—Messrs A M. Reuther and E A Down, Deputy Conservator of Forests respectively made over and received charge of the Baluchistan Forests on the afternoon of July 9th 1896, from which date the former reverted to his substantive appointment of Deputy Conservator, 2nd grade, and the latter was promoted to officiate in the 1st grade

11*th January* 1897 No $\frac{13}{A\ L\ No\ 3}$—In notification No. $\frac{872}{A\ L\ No.\ 22}$ dated the 3rd August 1896, for Mr A M Reuther "read Mr. E. A. Down".

16*th January* 1897 —No. $\frac{34}{A\ L\ No\ 4}$—*Leave* —Mr C. P. Fisher, Deputy Conservator of Forests, has been granted 18 months' furlough, with effect from 15th March or such subsequent date as he may avail himself of it

25*th January* 1897.—No. 51 —*Leave.*—Mr. Fazl Din, Extra Assistant Conservator of Forests, has been granted 18 months' furlough with effect from 1st March 1897, or such subsequent date as he may avail himself of it.

7.—CENTRAL PROVINCES GAZETTE.

7th January 1897.—No. 63.—With reference to Order No 5067, dated the 23rd December 1896, Messrs. C. O. Hanson, Officiating Deputy Conservator of Forests, and L. Gisborne Smith, Deputy Conservator of Forests, respectively made over and assumed charge of the Sambalpur Forest Division on the 12th idem.

7th January 1897.—No. 64 —With reference to Order No. 5068, dated the 23rd December 1896, Mr. C O. Hanson, Officiating Deputy Conservator of Forests, assumed charge of his duties in the Direction Division on the forenoon of the 21st idem

7th January 1897.—No. 66.—Privilege leave for three months, under Articles 277 and 291 of the Civil Service Regulations, is granted to Mr. C. O. Hanson, Officiating Deputy Conservator of Forests, Central Provinces, with effect from the 19th January 1897, or the subsequent date on which he may be permitted to avail himself of it.

7th January 1897.—No. 73.—Mr. R S. Hole, Assistant Conservator of Forests, appointed by Her Majesty's Secretary of State for India to the Indian Forest Service, is posted to the Hoshangabad Forest Division.

Mr. Hole assumed charge of his duties at Hoshangabad on the forenoon of the 7th December 1896.

7th January 1897.—No. 75.—With reference to Order No. 4330, dated the 12th November last, Mr. A. St. V. Beechey, Assistant Conservator of Forests, assumed charge of the Pranhita-Godavery Sub-Division, in the Chanda Forest Division, on the forenoon of the 27th idem.

28th January 1897 —No. 515.—Mr. C. O. Hanson, Officiating Deputy Conservator of Forests, attached to the Direction Division, availed himself, on the afternoon of the 21st instant, of the three months' privilege leave granted him by Order No. 66 of the 7th idem.

8.—BURMA GAZETTE.

21st December 1896.—No. 27.—With reference to Revenue Department Notification No 567 (Forests), dated the 11th December 1896, Mr. E. B. Powell, Extra Assistant Conservator of Forests, received charge of the Myadaung subdivision, Katha division, from the Deputy Conservator of Forests, Katha division, on the forenoon of the 15th instant.

28th December 1896.—No. 576.—Mr. H. B. Ward, Deputy Conservator of Forests, Personal Assistant to the Conservator of Forests, Pegu and Tenasserim Circles, is posted to the charge of the Depôt and Agency Division, Rangoon, during the absence of Mr. J. Allmark, on furlough, or until further orders.

28th December 1896.—No. 577.—Under the provisions of Article 371 (*a*) of the Civil Service Regulations, furlough for one year is granted to Mr J. Allmark, Extra Deputy Conservator of Forests, with effect from the 15th January 1897, or the subsequent date on which he may avail himself of it.

28th December 1896.—No. 580 —Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

29th December 1896.—No. 20.—With reference to Revenue Department Notification No. 535, dated 4th December 1896, Mr. G. E. S. Cubitt, Assistant Conservator of Forests, reported himself for duty at Prome on the forenoon of the 10th instant.

31st December 1896—No. 27.—Mr. E C. Florey, Forest Ranger, 3rd grade, in the Kado division, is granted 30 days' privilege leave, with effect from the 15th December 1896.

4th February 1897.—No 1—With reference to Revenue Department Notification No. 482 (Forests), dated the 10th November 1896, Mr. H. B. Ward, Deputy Conservator of Forests, relinquished charge of his duties as Personal Assistant to the Conservator of Forests, Pegu Circle, on the forenoon of this date.

7th January 1897.—No. 1.—(Corrigendum).—In this department Notification No. 535, dated the 4th December 1896, *for* "5th December" *read* ' 4th December."

No. 2.—Mr. J. W. Ryan, Extra Assistant Conservator of Forests, 4th grade, on probation, is confirmed in his appointment, with effect from the 21st September 1896.

12th February 1897.—No. 1.—With reference to Revenue Department Notification No. 537 (Forests), dated the 4th December 1896, Mr. G. K. Parker, Assistant Conservator of Forests, assumed charge of his duties on the 18th December 1896.

13th February 1897.—No. 6—The following alterations in rank are ordered in the Forest Department :

(1) With effect from the 25th July 1896, consequent on the retirement of Mr. C. W. Palmer :—

Mr. J. C. Murray, Deputy Conservator, 2nd grade, provisionally substantive), and officiating Deputy Conservator, 1st grade, to be Deputy Conservator, 2nd grade, and to continue to officiate as Deputy Conservator, 1st grade.

Mr. J. Copeland, Deputy Conservator, 3rd (officiating 2nd) grade, to be Deputy Conservator, 2nd grade, provisionally substantive.

Mr. H. Carter, Deputy Conservator, 4th (officiating 3rd) grade to be Deputy Conservator, 3rd grade, provisionally substantive.

Mr. H. H. Forteath, Assistant Conservator, 1st grade (officiating Deputy Conservator, 3rd grade), to be Deputy Conservator, 4th grade, and to continue to officiate as Deputy Conservator, 3rd grade.

(2) With effect from the 18th September, 1896, consequent on the transfer of Mr. C. M. Hodgson to Burma:—

Mr. C. M. Hodgson, Deputy Conservator 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. S. Carr, Assistant Conservator, 1st grade (officiating Deputy Conservator, 3rd grade), to officiate as Deputy Conservator, 4th grade.

(3) With effect from the 9th October 1896, consequent on the transfer of Mr. H. Calthrop to Burma :—

Mr. H. Calthrop, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. H. Carter, Deputy Conservator, 3rd (officiating 2nd) grade, to revert to his substantive appointment.

(4) With effect from the 16th October 1896, consequent on the return of Mr. H. Hill from privilege leave :—

Mr. C. L Toussaint, Deputy Conservator, 3rd (officiating 2nd grade, to revert to his substantive appointment.

Mr. A. M. Burn-Murdoch, Assistant Conservator, 1st grade, (officiating Deputy Conservator, 3rd grade), to officiate as Deputy Conservator, 4th grade.

(5) With effect from the 12th November 1896, consequent on the return from privilege leave of Mr. H. Carter.

Mr. G. R. Long, Assistant Conservator, 1st grade (officiating Deputy Conservator, 3rd grade), to officiate as Deputy Conservator, 4th grade.

(6) With effect from the 3rd November 1896 —

Mr C. Smales to be Assistant Conservator, 1st grade, and to officiate as Deputy Conservator. 4th grade—

(7) With effect from the 3rd December, 1896, consequent on the return of Mr J. Copeland from privilege leave.

Mr M. Hill, Deputy Conservator, 3rd (officiating 2nd) grade to revert to his substantive apppointment.

Mr C. R. Dun, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive appointment.

13th January 1897.—No. 11 —On return from leave Mr. C E. Muriel, Deputy Conservator of Forests, is posted to the charge on the Rangoon Forest Division.

No 12 —Mr. H N. Thompson, Deputy Conservator of Forests, is transferred from Bassein to the Southern Shan States, Forest Division.

No. 13.—Mr. C. W. Allan, Extra Assistant Conservator of Forest, in charge of the Henzada-Thongwa Forest Division, is appointed to the charge of the Bassein Myaungmya Forest Division in addition to his other duties as a temporary measure.

16th January 1897.—No 2.—With reference to Revenue Department Notification No 576 (Forests), dated the 28th December 1896, Mr. J Allmark, Extra Deputy Conservator of Forests, and Mr. H. B. Ward, Deputy Conservator of Forests, respectively made over and received charge of the Depôt and Agency division, Rangoon, on the afternoon of the 15th January 1897.

No. 3 —With reference to Revenue Department Notification No. 11 (Forests), dated the 14th instant, Mr. H. B. Ward, Deputy Conservator of Forests, and Mr. C E. Muriel, Deputy Conservator of Forests, respectively made over and received charge of the Rangoon Forest division on the forenoon of the 14th January 1897.

19th January 1897.—No 16.—On return from leave Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, is posted to the charge of the Bassein-Maungmya Forest division.

21st January 1897.—No. 19 —Under the provisions of Article 340 (*b*) of the Civil Service Regulations, furlough for 18 months is granted to Mr. G. F. R. Blackwell, Deputy Conservator of Forests, in supersession of the leave on medical certificate granted to him in this department' Notification No. 563, dated the 10th December 1896.

No. 20.—Mr. H. N. Thompson, Deputy Conservator of Forests, is appointed to the charge of the Southern Shan States Forest Division, *vice* Mr. C. R. Dun, transferred.

No. 21.—Mr. C. R Dun, Deputy Conservator of Forests, is transferred from Taunggyi to the charge of the Mu Forest division.

No 22.—Mr. A. E. Ross, Assistant Conservator is transferred from the North Tharrawaddy subdivision to the Southern Shan States Forest division.

No. 23—Mr A H M Lawson, Assistant Conservator, is posted to the charge of the North Tharrawaddy subdivision, *vice* Mr Ross, transferred.

21st January 1897 —No 67. Under the provisions of Article 340 (*b*) of the Civil Service Regulations, furlough for 18 months is granted to Mr. C. L. Toussaint, Deputy Conservator of Forests, with effect from the date on which he avail himself of it.

No. 28—Under the provisions of Article 3 8 of the Civil Service Regulations special leave for six months is granted to Mr. C M Hodgson Deputy Conservator of Forests, with effect from the 1st February 1897, or the subsequent date on which he may avail himself of it.

No. 29—Mr. H B. Anthony, Deputy Conservator of Forests, is appointed to the charge of the Ataran Forest, Division, in addition to his other duties, during the absence of Mr. Hodgson on leave or until further orders.

9.—ASSAM GAZETTE.

13th January 1897.—No 175G—Mr. H. S Ker Edie, M A, Deputy Conservator of Forests, under orders of transfer to the charge of the Kamrup Forest Division (*vide* Notification No 6691G, dated the 13th October 1896), was attached to the Darrang Forest Division on special duty from the 26th October to the 15th December 1896, both days inclusive.

29th January 1897—No 746.—In supersession of Notification No. 6558G, dated the 7th October 1896, the following changes in rank are ordered, consequent on the return from furlough of Mr. E. E Fernandez, Deputy Conservator of Forests. First Grade and on his temporary deputation to Ajmere with effect from the 17th June 1896:

- Mr. J. L. Pigot, Officiating Deputy Conservator of Forests, First Grade *seconded*, to continue to officiate in that grade, and to be *seconded*.
- Mr. D. P. Copeland Officiating Deputy Conservator of Forests. First Grade (provisionally substantive Second Grade), to continue to officiate in the First Grade, and to be provisionally substantive in the Second Grade.
- Mr. H. G. Young, Officiating Deputy Conservator of Forests, Second Grade, (provisionally substantive Third Grade), to continue to officiate in the Second Grade, and to be provisionally substantive in the Third Grade.
- Mr. T. J Campbell, Officiating Deputy Conservator of Forests, Third Grade, to continue to officiate in that grade.
- Mr. A. M. Long Officiating, Deputy Conservator of Forests, Fourth Grade, to continue to officiate in that grade.

29th January 1897—No. 747G—In supersession of Notification No. 6559G., dated the 7th October 1896, the following changes in rank are ordered, consequent on the reversion to the Assam List of Mr. J. L

Pigot, Officiating Deputy Conservator of Forests, First Grade, *seconded*, and his departure on furlough, with effect from the 1st July 1896 :

Mr. D. P. Copeland, Officiating Deputy Conservator of Forests, First Grade (provisionally substantive Second Grade), to revert to his substantive appointment as Deputy Conservator of Forests, Third Grade, but to continue to officiate as Deputy Conservator of Forests, First Grade.

Mr. A. G. Young, Officiating Deputy Conservator of Forests, Second Grade (provisionally substantive Third Grade), to revert to his substantive appointment of Deputy Conservator of Forests, Fourth Grade, but to continue to officiate as Deputy Conservator of Forests, Second Grade.

Mr. H. S. Ker-Edie, Deputy Conservator of Forests, Fourth Grade, provisionally substantive, to revert to his substantive appointment of Assistant Conservator of Forests, First Grade and to officiate as Deputy Conservator of Forests, Fourth Grade.

Mr. F. E B. Lloyd, Assistent Conservator of Forests, First Grade, provisionally substantive, to revert to his substantive appointment of Assistant Conservator of Forests, Second Grade, and to officiate as Assistant Conservator of Forests, First Grade.

29th January 1897.—No. 748G —In supersession of Notification No. 6560G., dated the 7th October 1896 the following temporary promotions are made, with effect from the 13th July 1896, consequent on the departure on privilege leave of Mr. D. P. Copeland, Officiating Deputy Conservator of Forests, First Grade :

Mr. H. G. Young, Officiating Deputy Conservator of Forests, Second Grade, to officiate as Deputy Conservator of Forests, First Grade.

Mr. T. J. Campbell, Officiating Deputy Conservator of Forests, Third Grade, to officiate as Deputy Conservator of Forests, Second Grade.

Mr. J. E. Barrett, Deputy Conservator of Forests; Fourth Grade, to officiate as Deputy Conservator of Forests, Third Grade.

Mr. F. E. B Lloyd, Officiating Assistant Conservator of Forests, First Grade, to officiate as Deputy Conservator of Forests, Fourth Grade.

29th January 1897.—No. 740G.—Consequent on Mr. E. E. Fernandez, Deputy Conservator of Forests, First Grade, Assam, on temporary deputation to Ajmere, having been attached to the Forest Department in the Central Provinces the following reversions are ordered, with effect from the 28th September 1896 :—

Mr. D. P Copeland, Officiating Deputy Conservator of Forests, First Grade, on privilege leave, to officiate as Deputy Conservator of Forests, Second Grade.

Mr. H. G Young, Officiating Deputy Conservator of Forests, First Grade, to officiate as Deputy Conservator of Forests, Second Grade.

Mr. T. J. Campbell, Officiating Deputy Conservator of Forests, Second Grade, to officiate as Deputy Conservator of Forests, Third Grade.

Mr. J. E. Barrett, Officiating Deputy Conservator of Forests, Third Grade, to revert to his substantive appointment of Deputy Conservator of Forests, Fourth Grade.

Mr. F. E.B. Lloyd Officiating Deputy Conservator of Forest, Fourth Grade, to officiate as Assistant Conservator of Forests, First Grade.

29th January 1997.—No. 750G.—With effect from the 13th October 1896, in consequence of the return to duty of Mr. D. P. Copeland, Officiating Deputy Conservator of Forests, Second Grade, from privilege leave·

Mr. H. G. Young Officiating Deputy Conservator of Forests, Second Grade, to officiate as Deputy Conservator of Forests, Third Grade.

Mr. T. J. Campbell, Officiating Deputy Conservator of Forests, Third grade, to revert to his substantive appointment of Deputy Conservator of Forests, Fourth grade.

Mr. A. M. Long, officiating Deputy Conservator of Forests, Fourth grade, to revert to his substantive appointment of Assistant Conservator of Forests, First grade.

29th January 1897.—No. 751—G With effect from the 18th October 1897 in consequence of Mr. E. E. Fernandez, Deputy Conservator of Forests, First grade, attached to the Forest Department in the Central Provinces, having been appointed to officiate as Conservator of Forests, Third grade, in charge of the Northern Forest Circle, Central Provinces:

Mr D.P. Copeland, Officiating Deputy Conservator of Forests, Second grade, to officiate as Deputy Conservator of Forests, First grade

Mr H. G. Young, officiating Deputy Conservator of Forests, Third grade, to officiate as Deputy Conservator of Forests, Second grade.

Mr T. J. Campbell, Deputy Conservator of Forests, Fourth grade, to officiate as Deputy Conservator of Forests, Third grade.

Mr. A M Long, Assistant Conservator of Forests, First grade, to officiate as Deputy Conservator of Forests, Fourth grade.

10—HYDERABAD GAZETTE.

15th January 1897 —No. 13.—With reference to Notification No. 3765 dated the 24th September 1896, published on page 180 of Part II of the *Central Provinces Gazette.* No. 39, dated the 26th September 1896, the Resident is pleased to make the following promotions, with effect from the 1st January 1896, consequent on the promotion of Mr. S. G. Pranjpe, from the 2nd to the 1st grade of Extra Assistant Conservator of Forests :—

Mr. G. H. Haldane, Extra Assistant Conservator, 3rd grade, to be Extra Assistant Conservator, 2nd grade.

Mr B. Bhukan, Extra Assistant Conservator, 4th grade, to be Extra Assistant Conservator, 3rd Grade.

29th January 1897.—No 28.—Mr. S. L. Kenny. Assistant Conservator of Forests 2nd grade. transferred from the Central Provinces to Berar, reported his arrival at Amraoti on the afternoon of the 27th December 1896, and is attached to the Ellichpur Forest Division, with effect from the forenoon of the 28th December 1896.

II.—MYSORE GAZETTE.

8th January 1897.—No. 6170.—Ft. F. 7-96.—Under Article 171 of the Mysore Service Regulations, Mr. J J Monteiro, Officiating Assistant Conservator of Forests. Shimoga district, was granted three days' casual leave of absence from the 5th December 1896.

23rd January 1897.—No. 6578.—Ft. F. 31-96.—Mr. G. E. Ricketts, Assistant Conservator of Forests, is posted for special duty in the Hassan district.

VIII—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

5th February 1897.—No 150—71-2-F —Furlough for two years, under Article 340 (*b*) of the Civil Service Regulations, is granted to Mr. C. G. Rogers, Instructor at the Imperial Forest School, Dehra Dun, with effect from the 1st February 1897, or the subsequent date on which he may avail himself of it.

5th February 1897.—No. 153—26-8-*F*.—Mr. A. L. Home, Conservator of Forests, 1st grade, Assam, is granted privilege leave for three months, under Articles 277 and 291 of the Civil Service Regulations with effect from the 2nd February 1897.

The following temporary promotions are ordered during Mr. Home's absence, or until further orders:—

(i) Mr. S. Eardley-Wilmot, Conservator, 2nd grade, North-Western Provinces and Oudh, to officiate in the 1st grade.

(ii) Mr. E. G Chester, Deputy Conservator, 1st grade, Bengal, to officiate as Conservator, 3rd grade, in charge of the Assam Forest Circle.

9th February 1897 —No. 171 F. 55—7—Privilege leave for one month and fifteen days, under Articles 291 and 282 (*a*) (ii) of the Civil Service Regulations, is granted to Mr. A. Smythies, Officiating Conservator of Forests, Western Circle, Upper Burma, with effect from the 20th January, 1897.

Mr. J. Nisbet, Officiating Conservator, Eastern Circle, Upper Burma, is placed in charge of the Western Circle, in addition to his other duties during Mr Smythies' absence or until further orders.

26th February 1897.—No. 226—71-3-F —Mr C. G. Rogers, Instructor at the Imperial Forest School, availed himself on the 5th February 1897, of the furlough granted him in the notification of this Department, No. 159 F., dated the 5th instant

From the same date Mr, Rogers reverted to the Bengal Forest List.

2.—Madras Gazette.

4th February 1897.—No. 60.—

No.	Name of officer.	District.	Nature of charge.	Remarks.
1	M. R. Ry. V. S. Gurunatha Pillai Avargal.	South Malabar.	Acting District Forest Officer.	During the absence of Mr. Hadfield on furlough or until further orders.

8th February 1897.—_Leave._—The Board of Revenue has granted to Mr. H. Tireman, District Forest Officer, North Malabar, privilege leave for sixteen days from the 16th instant.

10*th February* 1897.—*Leave.*—Three months' privilege leave granted to Mr O'Neill, Forest Ranger, South Coimbatore from date of relief.

15*th February* 1897 —No. 67 —Mr Hayne, District Forest Officer, Chingleput, furlough for two years from or about the 1st March 1897, under Article 340 (*b*) of the Civil Service Regulations,

17*th February* 1897.—*Leave* —To M. Callanan, Forest Ranger, Salem District, for three months from 10th February 1897, under Article 369 of the Civil Service Regulations.

19*th February* 1897.—Seyed Burhan-ud din Hussain, Acting Ranger, 4th grade, sub. *pro tem* , Salem District, to continue to act in that grade sub. *pro tem* , from 1st February 1897, in the vacancy caused by the promotion of C. M. Maduranayagam Pillai.

26*th February* 1897 —No 91 :—

No.	Name of officer.	District.	Nature of charge.	REMARKS.
1	Mr. A. B Jackson, Deputy Conservator of Forests, 4th grade.	Chingleput	Permanent from March 1st.	To work under the orders of the Collector and to be District Forest Officer after the departure of Mr. Hayne on furlough.
2	Mr. W. W. Batchelor, Acting Assistant Conservator of Forests, 1st grade.	Nellore	Permanent	With effect from January 16th 1897.
3	Mr. S Cox, Assitant Conservator, 1st grade, and Acting Deputy Conservator, 4th grade.	Vizagapatam	Do.	Do.

3.—BOMBAY GAZETTE.

10*th February* 1897.—No. 2977.—Mr S. B. Ranade, L. C. E., Extra Assistant Conservator of Forests, 4th Grade, transferred from the Thána District, reported himself to the Divisional Forest Officer, Panch Maháls for duty as Sub-divisional Forest Officer, Panch Maháls, on the forenoon of 14th January 1897.

24*th February* 1897.—No 7388 —Mr. G J. Rege, appointed acting Extra Assistant Conservator in Government Resolution No. 659 of 26th January 1897, and now doing duty in the Khánpur Range, is transferred to the office of the Conservator of Forests, S. C., for duty as Personal Assistant.

4.—BENGAL GAZETTE.

9*th Februury* 1897.—No. 550.—Mr. T. H. Monteath, Assistant Conservator of Forests 2nd grade, lately appointed by Her Majestys Secretary of State to the Forest Department of India, is attached to the Darjeeling Forest Division.

5.—N.-W. P. AND OUDH GAZETTE.

16*th February*, 1897.—No. 397—II-378C.—Mr. R. C. Milward, Assistant Conservator of Forests, from the Direction to the Naini Tal Division of the Central Forest Circle.

6.—PUNJAB GAZETTE.

4*th February* 1897.—No. $\frac{72}{\text{A. L No. 5}}$.—*Notification.*—The following changes have taken place in the list of Forest Officers on the Associated Provinces with effect from the dates specified against each :—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from	REMARKS.
Mr. F. O. Lemarchand ...	Provisional Deputy Conservator, 1st grade.	Deputy Conservator, 1st grade.	December 8th.	Consequent on the promotion of Mr. Elliott to the class of Conservators.
Mr. G. F. Prevost ...	Deputy Conservator, 2nd grade, and Officiating Conservator.	Provisional Deputy Conservator, 1st grade.		
Mr. J. H. Lace ...	Provisional Deputy Conservator, 2nd grade.	Deputy Conservator, 2nd grade.		
Mr. L. G. Smith ...	Deputy Conservator, 3rd grade (on furlough).	Provisional Deputy Conservator, 2nd grade (on furlough).		
Mr. H. A. Hoghton	Provisional Deputy Conservator, 3rd grade.	Deputy Conservator, 3rd grade.		
Mr. F. C. Hicks ...	Officiating Deputy Conservator, 3rd grade.	Provisional Deputy Conservator, 3rd grade.		
Mr. F. Linnell ...	Officiating Deputy Conservator, 4th grade.	* Assistant Conservator, 1st grade.		
Mr. B. O. Coventry	Provisional Assistant Conservator, 1st grade (on privilege leave).	Assistant Conservator, 1st grade (on privilege leave).		

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*The appointment transferred to the Provincial Service moves up into the 4th grade of Deputy Conservators; consequently one appointment in that grade is absorbed.

No. $\frac{73}{\text{A. L. No 6}}$ *Errata.*—In Notification No. $\frac{0}{\text{A. L. No. 1}}$, dated 8th January, *for* "Officiating Deputy Conservator, 2nd grade", opposite Mr. Gisborne Smith's name, *read* "Provisional Deputy Conservator, 2nd grade"; *for* Mr. "F. Linnell" *read* "Mr. R. M. Williamson"; and *for* "Mr. R. M. Williamson" *read* "Mr. E. M. Coventry."

No. $\frac{74}{\text{A L. No 7}}$.—*Notification.*—In Notification No $\frac{474}{\text{A L. No. 81}}$, dated 14th October 1896, *add* "Provisional Deputy Conservator, 4th grade, and" before the words "Officiating Deputy Conservator, 3rd grade," opposite the name of Mr. Caccia.

7.—CENTRAL PROVINCES GAZETTE.

9th February 1897.—No. 1.—Consequent on the grant of thirteen months' sick leave to Mr. F. W. Wightman, Forest Ranger, 4th grade, attached to the Seoni Forest Division, with effect from the 13th November 1895, the following acting promotions among Forest Rangers in the Central Provinces are ordered :—

Mr. Chhogalal, Forest Ranger, 5th grade, attached to the Bilaspur Forest Division to officiate as Forest Ranger, 4th grade, *vice* Mr. F. W. Wightman, leave.

Mr. Mathura Pershad, Forest Ranger, 6th grade, attached to the Nagpur-Wardha Forest Division, to officiate as Forest Ranger, 5th grade, *vice* Mr. Chhogalal, promoted.

No. 2.—Consequent on the grant of five months' extraordinary leave without pay to Mr. Ponnuswamy, Forest Ranger, 4th grade, attached to the Chanda Forest Division, with effect from the 21st December 1895, the following acting promotions among Forest Rangers in the Central Provinces are ordered :—

Mr. P. Shankarnath, Forest Ranger, 5th grade, attached to the Northern Circle, to officiate as Forest Ranger, 4th grade, *vice* Mr. Ponnuswamy, on leave.

Mr. D. Raja Rao, Forest Ranger, 6th grade, attached to the Balaghat Forest Division, to officiate as Forest Ranger, 5th grade, *vice* Mr. Shankarnath, promoted.

No. 3—Consequent on the deputation of Mr. A. Hunt, Forest Ranger, 4th grade, to the Bastar State, the following officiating promotions among Forest Rangers in the Central Provinces are ordered with effect from the 15th February 1896 :—

Mr. Chhogalal, Officiating Forest Ranger, 4th grade, attached to the Bilaspur Forest Division, to be Forest Ranger, 4th grade, sub. *pro tem*, *vice* Mr. Hunt, seconded.

Mr. J. D. St. Joseph, Forest Ranger, 5th grade, attached to the Northern Circle, to officiate as Forest Ranger, 4th grade, from the 16th February 1896, to the 20th May 1896, *vice* Mr. Shankarnath promoted.

Mr. P. Shankarnath, Officiating Forest Ranger, 4th grade, attached to the Northern Circle, to continue to officiate in that grade from the 21st to the 31st May 1896, *vice* Mr. Anthony, promoted.

Mr. F. J. Anthony, Officiating Forest Ranger, 4th grade, attached to the Northern Circle, to continue to officiate in that grade with effect from the 1st June 1896, *vice* Mr. Chhogalal, promoted.

Mr. Mathura Pershad, Officiating Forest Ranger, attached to the Nagpur Wardha Forest Division, to be Forest Ranger, 5th grade, sub. *pro tem.*, *vice* Mr Chhogalal.

Mr. K. Rama Rao, Forest Ranger, 6th grade, attached to the Seoni Forest Division, to officiate as Forest Ranger, 5th grade, from the 16th February 1896, to the 20th May 1896, *vice* Mr. Raja Rao

Mr. D. Raja Rao, Officiating Forest Ranger, 5th guard, to continue to officiate in that grade from the 21st to the 31st May 1896, *vice* Mr. Vithal Dhondu.

Mr. Vithal Dhondu, Officiating Forest Ranger, 5th grade, to continue to officiate in that grade from the 1st June 1896, *vice* Mr, Mathura Pershad.

No. 4.—Consequent on the grant of one year's sick leave to Mr. Govind Rao Tolay, Forest Ranger, 5th grade, attached to the Seoni Forest Division, the following officiating promotions among Forest Rangers in the Central Provinces are ordered with effect from the 22nd February 1896 :—

Mr Bhya Lal, Forest Ranger, 6th grade, attached to the Northern Circle, to officiate as Forest Ranger, 5th grade, from the 22nd February 1896, to the 20th May 1896, *vice* Mr. Rama Rao

Mr. K. Rama Rao, Officiating Forest Ranger, to continue to officiate in that grade from the 21st to the 31st May 1896, *vice* Mr Raja Rao

Mr. D Raja Rao, Officiating Forest Ranger, 5th grade, to continue to officiate in that grade from the 1st June 1896 to the 12th December 1896, *vice* Mr. Vithal Dhondu.

Mr Vithal Dhondu, Officiating Forest Ranger, 5th grade, to continue to officiate in that grade from the 13th December 1896 to the 21st February 1897, *vice* Mr. Govind Rao Tolay.

No. 5.—Consequent on the reduction of Mr. Bhawani Dutt, Forest Ranger, attached to the Chanda Forest Division, from the 5th to the 6th grade, the following promotions among Forest Rangers in the Central Provinces are ordered with effect from the 4th September 1896 :—

Mr. Mathura Pershad, Forest Ranger, 5th grade. sub. *pro tem.*, to be Forest Ranger, 5th grade, *vice* Mr. Bhawani Dutt, reduced

Mr. Vithal Dhondu, Officiating Forest Ranger, 5th grade, to be Forest Ranger 6th grade, sub *pro tem.*, *vice* Mr. Mathura Pershad.

Mr. K Rama Rao, Forest Ranger, 6th grade, to officiate as Forest Ranger, 5th grade, from the 4th September 1896 to the 12th December 1896, *vice* Mr Raja Rao.

Mr. D. Raja Rao, Officiating Forest Ranger, 5th grade, to continue to officiate in that grade from the 13th December 1896 to the 21st February 1897. *vice* Mr. Vithal Dhondu.

No. 6.—Consequent on the grant of six months' sick leave to Mr, Muhammad Yasin, Forest Ranger, 3rd grade, attached to the Northern Circle, the following officiating promotions among Forest Rangers in the Central Provinces are ordered with effect from the 7th September 1896 :—

Mr. A. Ponnuswamy, Forest Ranger, 4th grade, to officiate as Forest Ranger, 3rd grade, *vice* Mr. Muhammad Yasin, on leave.

Mr. P. Shankarnath Forest Ranger, 5th grade, to officiate as Forest Ranger, 4th grade, from the 7th September 1896 to the 12th December 1896, *vice* Mr. Anthony.

Mr. J. F. Anthony, Officiating Forest Ranger, 4th grade, to continue to officiate in that grade, from the 13th December 1896 to the 6th March 1897, *vice* Mr. Ponnuswamy, promoted.

Mr, Bhya Lal, Forest Ranger, 6th grade, to officiate as Forest Ranger, 5th grade, from the 7th September 1896, *vice* Mr. Rama Rao.

Mr. K. Rama Rao, Officiating Forest Ranger, 5th grade, to continue to officiate in that grade from the 13th December 1896 to the 21st February 1897, *vice* Mr. Rama Rao.

Mr. D. Raja Rao, Officiating Forest Ranger, 5th grade, to continue to officiate in that grade from the 22nd February 1897 to the 6th March 1897, *vice* Mr Anthony.

Notifications Nos. 3 and 4 of the 10th March 1896, as well as No 2 of the 6th August 1896, ordering the promotion of certain Forest Rangers in the Central Provinces, are hereby cancelled

Erratum —In the 33rd line of Notification No. 1 of the 6th August 1896, *for* "D. Raja Rao, Forest Ranger, 6th grade," *read* "Vithal Dhondu. Forest Ranger, 6th grade."

6th February 1897 —No. 720.—The undermentioned officers of the Forest Department are placed on special famine duty and are posted to the Jubbulpore Distrct :—

(1) Mr. F. Linnell, Officiating Deputy Conservator.
(2) Mr. C. M. McCrie, Assistant Conservator.
(3) Mr. R. C. Thompson, Extra-Assistant Conservator.

18th February, 1897.—No. 1031.—Mr. R. C. Thompson, Extra-Assistant Conservator of Forests, who was placed on special famine duty and posted to the Jubbulpore District by Order No. 720, dated the 6th February 1897, is transferred on the same duty to the Damoh District.

19th February 1897.—No. 1055 —Extraordinary leave for six months, under Article 366 of the Civil Service Regulations, is granted to Mr F. S. Barker, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

25th February 1897.—No 1248.—Mr. Narain Pershad, Forest Ranger and Working-Plans Assistant, Seoni, is placed in charge of the Seoni Forest Division, *vice* Mr. F. Linnell, Officiating Deputy Conservator of Forests, placed on famine duty by Order No. 720, dated the 5th instant.

8.—BURMA GAZETTE.

31st January 1897.—No. 30.—Messrs. R. L. Pocock and W. H Craddock are appointed to be supernumerary Extra Assistant Conservators, 4th grade.

1st February 1897.—No. 32.—Mr. A. M. Reuther was appointed to be Deputy Conservator of Forests, 1st grade, substantively provisional, with effect from the 30th July 1896.

1st February 1897.—No. 33 —Mr. H. Calthrop was appointed to be Deputy Conservator of Forests, 3rd grade, in Burma, with effect from the 9th October 1896.

1*th February* 1896.—No 34.—Mr C. M Hodgson was appointed to be Deputy Conservator of Forests, 4th grade, in Burma, with effect from the 18th September 1896

1*st Februury* 1897.—No 35.—On relief by Mr G R. Long, Mr. H N. Thompson, Deputy Conservator of Forests, was transferred from the charge of the West Salween Forest division to the charge of the Thayetmyo Forest division during the absence on privilege leave of Mr. H. Carter

3*rd February* 1897.—No 38.—Lieutenant-Colonel C. T. Bingham, I. S. C., Conservator of Forests, has been granted by Her Majesty's Secretary of State for India an extension of leave for 43 days

9*th February* 1897.—No 1.—Mr C. M Hodgson, Deputy Conservator of Forests, availed himsefl of the six months' special leave granted him in Notification No 28 (Forests), dated the 21st January 1897, on the afternoon of the 3rd February 1897

10*th February* 1897.—No 3.—With reference to Revenue Department Notification No 20 (Forests), dated the 21st January 1897, Mr. H. N Thompson, Deputy Conservator of Forests received charge of the Southern Shan States division from Mr C R Dun, Deputy Conservator of Forests, on the afternoon of the 3rd instant,

17*th February* 1897.—No. 68.—Mr. W. H. Craddock, supernumerary Extra Assistant Conservator of Forests, 4th grade, is posted to the charge of the Kyauksè subdivision of the Mandalay Forest Division

23*rd February* 1897.—No 5.—With reference to Revenue Department Notification No 21 (Forests), dated the 21st January 1897, Mr. C. L Toussaint, Deputy Conservator of Forests, made over, and Mr C. R Dun, Deputy Conservator of Forests, received, charge of the Mu division on the afternoon of the 18th February 1897.

No. 6.—With reference to Revenue Department Notification No. 27 (Forests), dated the 21st January 1897, Mr C L. Toussaint, Deputy Conservator of Forests, availed himself of subsidiary leave, preparatory to the furlough for 18 months granted in the above notification, on the afternoon of the 18th February 1897.

24*th February* 1897.—No 4.—With reference to Revenue Department Notification No 23 (Forests), dated the 21st January 1897, Mr. A. E. Ross Assistant Conservator of Forests, reported himself for duty at Taunggyi on the afternoon of the 17th instant.

9.—ASSAM GAZETTE.

4*th February* 1897.—No 869G.—Babu Jogeswar Sur, Extra Assistant Conservator of Forests, is transferred from the Darrang Forest Division to the Lakhimpur Forest Division.

26*th February* 1897.—No. 1420G.—Furlough on medical certificate for six months, under article 340 (*a*) of the Civil Service Regulations, is granted to Mr. A. M. Long, Officiating Deputy Conservator of Forests, in charge of the Garo Hills Forest Division, with effect from the 17th January 1897.

26*th February* 1897.—No. 1421G.—Mr. T. J. Campbell, Deputy Conservator of Forests, in charge of the Goalpara Forest Division, is placed in charge of the Garo Hills Forest Division, in addition to his own duties, during the absence on leave of Mr. A. M. Long, or until further orders.

26th Februavy 1897.—No. 1422G.—Mr. A. R. Dicks, Assistant Conservator of Forests, attached to the Goalpara Forest Division, is transferred to the Garo Hills Forest Division, and is attached to the latter division, with effect from the 27th January 1897,

10.—HYDERABAD RESIDENCY GAZETTE.

10th Februry 1897.—No. 41.—Mr. W. G. J. Peake, Extra Assistant Conservator of Forests, held charge of the Ellichpur Forest Division from the 23rd July to the 9th August 1896.

11.—MYSORE GAZETTE.

2nd February 1897.—No. 6971.—Ft. F, 92-95.—Under Article 173 of the Mysore Service Regulations, Mr. Y. Sitaramaiya, Assistant Conservator of Forests on Special Duty, Kadur district, is granted casual leave of absence for ten days, with effect from 1st February 1897 or such other date as he may avail himself of the same

Under Article 168 of the Mysore Service Regulations, Mr. M. G. Rama Row, Officiating Assistant Conservator of Forests, Kakenkote range, Mysore district, is granted privilege leave of absence for one month and fifteen days in extension of the fifteen days' privilege leave sanctioned in Government Notification No. 5609—Ft. F 62-95, dated 19th December 1896,

11th February 1897.—No 7236.—Ft. F. 7-96—Under Article 171 of the Mysore Service Regulations, Mr J J. Monteiro, Officiating Assistant Conservator of Forests, Shimoga district, was granted three days' casual leave of absence from the 8th February 1897.

9th February 1897—No. 9011—G. F. 328-92, En—The following candidates have passed the Civil, Part I, Examination held in November 1896 :—

Order of merit.	Register No.	Name.	Designation or Address.
3	140	Mr. G. E. Ricketts	Asst Conservator of Forests, Bangalore.

17th February 1897.—No. 7434—Ft. F. 1-96.—The two days' casual leave of absence granted to Mr. P. E. Benson, Sub-Assistant Conservator of Forests, in Notification No. 2713—Ft. F. 1-96, is hereby extended by one day.

25th February 1897.—No. 7540—Ft. F. 92-95.—Mr. Y. Sitaramaiya, Assistant Conservator of Forests, on special duty in the Kadur district, heaving availed himself of only eight days out of the ten days' casual leave granted to him in Government Notification No. 6971—Ft. F. 92-95, dated 2nd Fecruary 1897, the unexpired portion of the leave, *viz.*, two days, is hereby cancelled.

VIII—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

10*th March* 1897.—No. 251—88-6-F.—On return from the privilege leave granted him in the Notification of this Department, No. 1090-F., dated 16th December 1896, Mr. B. B. Osmaston, Deputy Conservator of Forests, 4th grade (provisionally substantive), North-Western Provinces and Oudh, is re-appointed Instructor at the Imperial Forest School, Dehra Dun, with effect from the 1st March 1897.

12*th March* 1897.—No 254—55 9-F.—On return from the privilege leave granted him in the Notification of this Department No. 171-F. dated the 9th ultimo, Mr. A. Smythies, Officiating Conservator of Forests, resumed charge of the Western Circle, Upper Burma, from Mr. J. Nisbet, Officiating Conservator of the Eastern Circle, with effect from the 6th instant.

19*th March* 1897.—No. 322—107-F.—Mr. E. M. Coventry, Assistant Conservator of Forests, 1st grade, Punjab, is transferred temporarily to the North-Western Provinces and Oudh in the interests of the public service.

2.—MADRAS GAZETTE.

1*st March* 1897.—Alur Kristna Rau, Deputy Ranger, 1st Grade, to act as Ranger, 5th Grade, sub. *pro tem.*, *vice* S. Arokiasami Pillai on leave with effect from 3rd February 1897.

9*th March* 1897.—The following promotion is ordered with effect from 28th November 1896 :—

M. S. Noronha, Ranger, 4th Grade, to be sub. *pro tem.* Ranger, 3rd Grade.

14*th March* 1897.—To C. N. Lakshmana Rao, Ranger, 3rd Grade, (Rs. 80), South Arcot District, to 2nd Grade (Rs 100), with effect from 27th November 1896.

8th March 1897.—Upon return from sick leave Ranger (3rd, temporarily 4th Grade) M. Callanan is transferred from the Salem to the Cuddapah District.

22*nd March* 1897.—To A. P. Ramachendra Mudaliar, Ranger, 5th Grade, North Arcot District, leave for one month, under article 291 of the Civil Service Regulations, in continuation of the two months' leave already granted to him—*vide* page 98 of Part II of the *Fort St. George Gazette*, dated 2nd February 1897.

23*rd March* 1897.—Ranger R. Sundram Pillai, Nilgiri District, granted sick leave for two months from 14th March 1897.

3.—BOMBAY GAZETTE.

12*th March* 1897.—No. 8717.—M. G. J. Rege, acting Extra Assistant Conservator of Forests, who was transferred to this office, handed over charge of the Khanápur Range, and assumed charge of his duties as Personal Assistant to the Conservator, on the forenoon of 2nd March 1897.

4.—BENGAL GAZETTE.

5th March 1897.—No. 1010.—Consequent on the temporary transfer to Assam of Mr. E. G Chester, Deputy Conservator of Forests, 1st grade, in charge of the Singhbhum Division, the following transfers and posting are ordered :—

Mr. E. P. Stebbing, Assistant Conservator of Forests, 1st grade, sub. *pro tem* , in charge of the Tista Division, is transferred to the charge of the Singhbhum Division, pending whose assumption of such charge, Mr. H. H. Spencer, Assistant Conservator of Forests. 2nd grade, attached to the Singhbhum Division, will hold charge of that division.

Mr. J. W. A Grieve, Assistant Conservator of Forests. 2nd and officiating 1st grade, attached to the Darjeeling Division, is transferred to the charge of the Tista Division, *vice* Mr. Stebbing.

16*th March* 1897--No. 1153-F.—Consequent on the return, on the 30th December 1896, of Mr C. G. D. Fordyce, Deputy Conservator of Forests, 2nd grade, from the furlough granted him in India Government, Revenue and Agricultural (Forests) Department, Notification No. 1290-254-10F , dated 17th December 1895, the following reversions of officers on the Bengal List of the Imperial Forest Service are ordered with effect from that date :—

Mr. W. M Green, Officiating Deputy Conservator of Forests, 2nd grade, to Deputy Conservator of Forests, 3rd grade.

Mr. H. D. D French, Officiating Deputy Conservator of Forests, 3rd grade, to Deputy Conservator of Forests, 4th grade.

Mr. F. Trafford, Officiating Deputy Conservator of Forests, 4th grade, to Assistant Conservator of Forests, 1st grade (provisional).

16*th March* 1897.—No 1167.—This Department Notification No. 5550For., dated 29th December 1896, published in the *Calcutta Gazette* of the 30th idem, is hereby cancelled.

5.—N.-W. P. AND OUDH GAZETTE.

2nd March 1897.—No. 490-L-665B.—Lala Permeshwari Din, Forest Ranger, 3rd grade, to be Extra Assistant Conservator of Forests, 4th grade, *sub. pro tem.* and to be posted to the Kheri Division of the Oudh Forest Circle.

2nd March 1897.—No. 489-II 665B.—With effect from the 24th December 1896, *vice* Mr. Keshwar Nand, Extra Assistant Conservator of Forests, 3rd grade, on deputation to the Tehri State.

Mr. E. L. Haslett, Extra Assistant Conservator of Forests, 4th grade, to be Extra Assistant Conservator of Forests, 3rd grade, substantive *pro tem.*

23*rd March* 1897.—No. 733-II-662C.—Mr. E. M. Coventry, Assistant Conservator of Forests, who has been transferred temporarily to these Provinces, to the charge of the Kumaun Division of the Central Forest Circle.

6.—PUNJAB GAZETTE.

10*th March* 1897.—No. $\frac{127}{\text{A. L No. 8.}}$—Mr. R. J. P. Pinder, Deputy Conservator of Forests, attached to the Direction Division, took over charge of the Shahpur Forests Division, the formation of which was sanctioned in letter No 1, dated 5th January 1897, from the Revenue Secretary to the Government of the Punjab, to the Conservator of Forests, Punjab, on the 5th and 8th of January and the 5th February, *viz.*, on the 5th January of the forests under the Deputy Commissioner, Shahpur, on the 8th January of the Bhera rakhs under the Extra Assistant Conservator of Forests, Chenab Division, and on the 5th February of the Khushab rakhs under the Extra Assistant Conservator of Forests, Jhelum Division.

12*th March* 1897.—No 137.—Mr. Fazl-ud-din and Khan Bahadur Munshi Fazl Din, Extra Assistant Conservators of Forests, respectively made over and received charge of the Chenab Forest Division on the afternoon of the 20th February 1897, consequent on the departure of the former on 18 months' furlough granted him in Punjab Government Notification No 51, dated 25th January 1897.

31*st March* 1897.—No. 161 —*Notification* —In consequence of the transfer of an appointment of Assistant Conservator of Forests, 1st Grade, from the list of officers in the Imperial Forest Service of the Associated Provinces and the creation of a second appointment of Extra Assistant Conservator of Forests, 1st Grade, in the Punjab Provincial Forest Service from the date of the transfer of Mr H. Calthrop Deputy Conservator of Forests, His Honor the Lieutenant-Governor is pleased to make the following promotions with effect from the 27th September 1897 :—

Babu Ladha Singh, Extra Assistant Conservator of Forests, 2nd Grade, to be Extra Assistant Conservator of Forests, 1st Grade.

Munshi Fazl Din, Khan Bahadur, Extra Assistant Conservator of Forests, 3rd Grade, to be Extra Assistant Conservator of Forests. 2nd Grade.

The 1*st February* 1897.

Forest Ranger Ráma Nand to be Extra Assistant Conservator of Forests, 4th Grade, on probation.

8.—BURMA GAZETTE.

5*th March* 1897.—No. 5.—Mr. R. A. Pinder, Forest Ranger, took charge of the Revenue subdivision, Mandalay division, on the forenoon of the 26th ultimo, from Mr. W. H. Craddock, Extra Assistant Conservator of Forests.

6*th March* 1897.—No. 6.—Mr. E. A. Moore, I.C.S., reported his arrival at Bhamo on the afternoon of the 12th January 1897, for Forest Settlement duty.

No. 7.—With reference to Revenue Department Notification No. 68 (Forests), dated the 18th February 1897, Mr. W. H. Craddock, Supernumerary Extra Assistant Conservator of Forests, received charge of the

Kyaukse subdivision from Mr. J. Copeland, Deputy Conservator of Forests, Mandalay division, on the afternoon of the 4th March 1897.

13th March 1897.—No. 2.—With effect from the 3rd February 1897, Mr C. V. Ryan, Forest Ranger, 3rd grade, is temporarily transferred from the Thaungyin to the Ataran division.

13th March 1897.—No. 8.—Under the provisions of Article 291 of the Civil Service Regulations, privilege leave for three weeks, with effect from the 23rd February 1897, is granted to Maung At, Forest Ranger, attached to the Pyinmana division.

13th March 1897.—No. 4.—With reference to Revenue Department Notification No. 77, dated the 25th February 1897, Mr G E. S. Cubitt, Assistant Conservator of Forests, assumed charge of his duties in the Tharrawaddy division on the forenoon of the 26th February 1897.

18th March 1897.—No. 106—Mr. R. L Pocock, Supernumerary Extra Assistant Conservator of Forests, was posted to the Katha Forest division, with headquarters at Katha.

20th March 1897.—No. 5—With effect from the 9th March 1897, Mr. B. P. Kelly, 4th grade Forest Ranger, on the temporory establishment, is appointed 3rd grade Forest Ranger on the permanent establishment.

22nd March 1897.—No. 6.- Mr R. R O'Hara is appointed a Forest Ranger, 3rd grade, from the 2nd instant and posted to the Thayetmyo division.

25th March 1897—No. 109.—Mr. C. E. Allen is appointed to be a supernumerary Extra Assistant Conservator, 4th grade, and is posted to the Tharrawaddy division

No. 110.—The following alterations in rank are ordered in the Forest Department:—

(1) With effect from the 6th December 1896, consequent on the retirement of Mr. M H. Ferrars Deputy Conservator, 1st grade—

Mr. A. M. Reuther, Deputy Conservator, 1st grade, ***substantive provisional***, to be Deputy Conservator, 1st grade

Mr. E. S. Carr, Deputy Conservator, 2nd (officiating 1st) grade, to be Deputy Conservator, 1st grade, ***substantive provisional.***

Mr. J. Copeland, Deputy Conservator, 2nd grade, ***substantive provisional***, to be Deputy Conservator, 2nd grade.

Mr H. B. Anthony, Deputy Conservator, 3rd (officiating 2nd) grade, to be Deputy Conservator, 2nd grade. ***substantive provisional.***

Mr. H. Carter, Deputy Conservator, 3rd grade ***substantive provisional*** to be Deputy Conservator, 3rd grade.

Mr. F J. Branthwaite, Deputy Conservator, 4th (officiating 3rd) grade. to be Deputy Conservator, 3rd grade, ***substantive provisional.***

Mr. G R. Long, Assistant Conservator, 1st grade, (officiating Deputy Conservator, 4th grade), to be Deputy Conservator, 4th grade, ***substantive provisional.***

(2) With effect from the 16th December 1896, consequent on the retirement of Mr J. T. Jellicoe, Deputy Conservator, 1st grade :

Mr. E. S. Carr, Deputy Conservator, 1st grade, ***substantive provisional***, to be Deputy Conservator, 1st grade.

Mr. H. B. Ward, Deputy Conservator, 2nd (officiating 1st) grade, to be Deputy Conservator, 1st grade, ***substantive provisional.***

Mr. H. B, Anthony, Deputy Conservator, 2nd grade, ***substantive provisional***, to be Deputy Conservator, 2nd grade.

30*th March* 1897.—No. 114.—Under the provisions of Article 840 (b) of the Civil Service Regulations, furlough for one year and six months is granted to Mr. C. R. Dun, Deputy Conservator of Forests, with effect from the day on which he may avail himself of it.

No. 115.—Mr. C. B. Smales, Assistant Conservator of Forests, is transferred from Gangaw and is posted to the charge of the Mu Forest division during the absence on furlough of Mr. Dun, or until further orders.

31*st March* 1897.—No. 118 (Forests).—Lieutenant-Colonel C. T. Bingham, Conservator of Forests, has been granted by Her Majesty's Secretary of State for India an extension of leave for 14 days.

31*st March* 1897.—No. 119 —Lieutenant-Colonel C. T. Bingham, Conservator of Forests, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

31*st March* 1897.—No. 7.—With reference to Revenue Department Notification No. 109, dated the 25th March 1897, Mr. C. E. Allen, Supernumerary Extra Assistant Conservator of Forests, reported himself for duty in the Tharrawaddy division on the forenoon of the 27th instant.

9.—Assam Gazette.

19*th March* 1897.—No. 2015G.—Consequent on the departure on furlough of Mr. A. M. Long, Officiating Deputy Conservator of Forests, Fourth Grade, Mr. F. E. B. Lloyd. Officiating Assistant Conservator of Forests, 1st Grade, is appointed to officiate as Deputy Conservator of Forests, 4th Grade, with effect from the 17th January 1897.

10.—Hyderabad Residency Gazette.

30*th March* 1897.—No. 108.—The Resident is pleased to declare that at the Departmental Examination held at Amraoti on the 8th and 9th March 1897, under section 72 of the Forest Department Code, the undermentioned Forest Officer in the Hyderabad Assigned Districts passed in the subjects specified against his name :—

Mr. M. Narsingh Rao, Forest Ranger,	Marathi (higher standard). Forest Law.

11.—Mysore Gazette.

22*nd January* 1897.—No. 6463—Ft. F. 27-95.—Mr. H. Srinivasa Row, *sub. pro tem.* Sub-Assistant Conservator of Forests, attached for duty to the Mysore district, will continue in that district until further orders,

2. Mr. M. Srinivasa Rao, Acting Extra Assistant Conservator of Forests, attached for duty to the Shimoga district, will continue in that district until further orders.

4th March 1897.—No 7645—Ft. F. 91 95.—Mr. B Srinivasa Row, Assistant Conservator of Forests, having returned to duty on the forenoon of the 4th February 1897, the unexpired portion of the leave granted to him in Notification No. 4945—Ft. F. 91-95, dated 1st December 1896, *viz.*, one day, is cancelled, and he is posted to the Mysore district, for the charge of the Kakenkota Forest Range, during the absence of Mr. M. G. Rama Row on leave ar until further orders

30th *March* 1897.—No. 8556—Ft F. 64-95.—Under Article 172 of the Mysore Service Regulations, Mr. M. Venkatanaranappa, Assistant Conservator of Forests, Tumkur district, was granted casual leave of absence for thirteen days with effect from the 26th February 1897.

VIII--EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

7th May 1897.—No 411—26-10 F —Mr A. L Home, Conservator of Forests, 1st grade, having returned from the privilege leave granted him in the Notification of this Department No 1[illegible] 3 F dated the 5th February last, and resumed charge of the Assam Forest Circle from Mr E G Chester, Officiating Conservator, 3rd grade, the following reversions took effect from the 2nd instant ·

(i) Mr Chester to his substantive appointment of Deputy-Conservator, 1st grade, Bengal

(ii) Mr S Eardley-Wilmot, Conservator, 2nd (officiating 1st) grade, in charge of the Oudh Forest Circle, North-Western Provinces and Oudh, to his substantive appointment in the 2nd grade.

14th May 1897 —No 426—168 2 F —Furlough for nine months, under article 340 (*b*) of the Civil Service Regulations, is granted to Mr. E F. Litchfield Deputy Superintendent, 2nd (officiating 1st) grade, Survey of India Department, attached to the Forest Survey Branch, with effect from the 15th instant, or the subsequent date on which he may avail himself of it

21st May 1897 —No. 457—102 8 F —With reference to the Notification of this Department No 397 F dated the 30th ultimo, Lieutenant-Colonel C T Bingham I S C, Conservator of Forests 3rd grade, on return from furlough took over charge on the 8th May, 1897 of the Tenasserim Circle in Lower Burma from Mr G. F Prevost, officiating Conservator in charge of the Pegu Circle

From the same date Colonel Bingham will officiate in the 2nd grade of Conservator until further orders

28th May 1897 —No 471—124 2 F —With reference to the notification of this Department No 14 F dated the 7th January last, Mr R. S Hole, Assistant Conservator of Forests, 2nd grade, was posted to Berar on arrival from England and was transferred to the Central Provinces, with effect from the 7th December, 1896

2—MADRAS GAZETTE

1st *May* 1897 —*Reduction cancelled* —The temporary reduction of M. Shams-ud-din Sahib, Salem District, from Ranger, 5th grade, Rs. 60, to Ranger, 6th Grade (Rs 50), is cancelled.

3rd *May* 1897 —*Promotion* —So much of service order No. 179 of 1896 97 relating to the promotion of Deputy Ranger, B D'Sa to Ranger 6th grade, on Rs 50, will take effect from 25th March, 1897 instead of from 1st January, 1897

7th May 1897 —*Leave* —The Board of Revenue has granted, under article 291 of the Civil Service Regulations, privilege leave to Mr. H. A. Latham, District Forest Officer, Trichinopoly *cum* Tanjore, for one month from or after the 20th instant.

9th May 1897.—*Leave.*—To C. N Lakshman Rau, Ranger, 3rd Grade, South Arcot District, for three months, under article 291 of the Civil Service Regulations, from or after 10th May 1897.

10th May 1897.—*Transfer.*—On relief of the South Malabar District charge, Extra Assistant Conservator M. R. Ry. V. S. Gurunatha Pillai to return to Tinnevelly District.

15th May 1897 —*Promotion.*—S V. Venkatramana Aiyar, Forester, 2nd Grade, and Sub *pro tem.* Deputy Ranger, 3rd Grade, on Rs 30, is confirmed in his latter appointment and promoted to be Sub. *pro tem.* Ranger, 6th Grade, on Rs. 50, with effect from 1st April 1897, *vice* J. W. Ryan on other duty, or until further orders.

13th May 1897.—*Departmental Examination* —The following have passed the Departmental Examination held on 25th January 1897 in the subjects mentioned against each :—

1	**P Venkatareddi** ...	Revenue Head Gumastah, Godavari	Forest Act and Rules
2	**R Veerasami Naidu** ...	Acting Forester, Kistna District	Forest Act and Rules and Code and Accounts
3	**J Devedos** ...	Do.	Do.
4	**G Nagarathnam Naidu**	Forester and Acting Head Clerk, District Forest office, Bellary Do:	Do.
5	**M Ramakristna Rau** ...	Sub-Divisional Office Clerk, Kurnool	Do.
6	**Hanumantha Rau** ...	Acting Forester, Ganjam District	Do.
7	**C Seenayya** ...	Acting Deputy Ranger, Ganjam	Do.
8	**T V Subbarama Iyer**..	Forester, Anantapur ..	Forest Act and Rules
9	**V S Subramania Iyer**..	Do. Kistna ..	Do.
10	**S Hanumanthu** ...	Do. Bellary ...	Do.
11	**S Ramasami Iyer** ...	Temporary Deputy Ranger, Bellary	Forest Code and Accounts
12	**S V Venkatakristna Iyer.**	Do. Godavari ...	Do.

17th May 1897.—*Promotions.*—The following promotions are ordered in the Southern Circle :—

Name.	Present grade.	Grade to which promoted.	With effect from.	Remarks.
J W Ryan ...	**Ranger, 5th Grade on Rs. 50 (old scale)**	**Ranger, 5th Grade, on Rs. 60 (new scale)**	**1st June 1897**	**On other duty in Burma.**
E A Monisse	**Do. and Temporary Ranger, 4th Grade, on Rs. 80**	**Ranger, 5th Grade, on Rs. 60, but to continue to be Temporary Ranger on Rs 80**		
C V Ryan ...	**Deputy Ranger, 1st Grade**	**Ranger, 6th Grade, on Rs. 50**		**On other duty in Burma.**
A P Singaravelu Mudaliar	**Do.**	**Ranger, 6th Grade, on Rs. 50, sub.** ***pro tem***	**4th May 1897**	***Vice*** **C V Ryan on other duty, or until further orders**

17th May 1897.—*Transfers.*—The following transfers are ordered :—

Ranger G. W. Thompson, from Salem to North Arcot.

Ranger A. P. Ramachendra Mudaliar, from North Arcot to Salem—to join without delay.

19th May 1897 *Leave.*—One month's privilege leave to Ranger Venkataramana Iyer, North Malabar Division, from or after 15th June 1897.

28th May 1897.—*Promotions.*—F. S Brito Deputy Ranger, 1st Grade, to be Ranger, 6th Grade (new scale), with effect from 1st January 1897.

21st May 1897.—*Leave*—To D. J. Evers, Ranger 6th Grade, Trichinopoly District, for three months, under article 291 of the Civil Service Regulations, from date of relief.

Leave—To N. Balaji Singh, Ranger, 5th Grade, Nellore District, for three months, under article 369 of the Civil Service Regulations, in continuation of the leave already granted to him.

24th May 1897.—*Reversion.*—R. S. Bower, Ranger, 4th Grade, Salem District is reduced temporarily to 5th Grade with effect from 23rd May 1897.

27th May 1897. *Transfer*—Ranger F. S. Brito transferred from South Canara to South Coimbatore.

Promotion.—The promotion of Ranger M. S. Noronha, Madura District, ordered in Service Order 152 of 1896-97, will take effect from 1st January 1897 " instead of from 28th November 1896.

3.—BOMBAY GAZETTE.

21st April 1897—No. 3013,—His Excellency the Governor in Council is pleased to appoint Mr. Ganpat Jayavant Rege to be Extra Assistant Conservator of Forests, Fourth Grade, from the date of Mr. R. H. Madan's promotion to be Extra Deputy Conservator of Forests.

1st May 1897 —No. 3316.—His Excellency the Governor in Council is pleased to direct that—

On finishing the special duty the completion of which is directed in Government Resolution No. 1058-FAM, of April 1897, the Honourable Mr. A. T. Shuttleworth should take up his permanent appointment as Conservator of Forests, Central Circle, and

Mr. W. G. Betham should hold administrative charge of the Southern Circle.

12th May 1897.—No. 726.—His Excellency the Governor in Council is pleased to direct that Mr. T. B. Fry should revert to his appointment as Professor of Forestry, College of Science, Poona, from the date of the Honourable Mr. A. T. Shuttleworth's taking up his permanent appointment as Conservator of Forests, Central Circle, on finishing the special duty on which he is deputed.

15th May 1397.—No. 3696.—His Excellency the Governor in Council is pleased to appoint Mr. Haripad Mitra, L. C. E. Extra Assistant Conservator of Forests, to be under the orders of the Conservator of Forests, Sind Circle.

31*st May* 1897.—No. 4077.—Mr. A, Stewart, Deputy Conservator of Forests and Divisional Forest Officer, Surat, is allowed furlough for eighteen months from 25th June 1897.

4.—BENGAL GAZETTE.

8*th May* 1897.—No. 1747.—Mr. H. H. Haines, F. C. H., Deputy Conservator of Forests, 4th grade, in charge of the Jalpaiguri Division is granted eight months' furlough, under article 340 (*b*) of the Civil Service Regulations with effect from the 25th April 1897, or from such subsequent date as he may avail himself of it,

Mr. H. A. Farrington, Assistant Conservator of Forests, attached to the Jalpaiguri Division, is placed in charge of that Division, *vice* Mr. Haine.

15*th May* 1897.—No. 270.—Consequent on the temporary transfer to Assam ot Mr. E. G. Chester, Deputy Conservator of Forests, 1st grade, the following officiating promotions are ordered among the officers on the Bengal List of the Imperial Forest Service, with effect from the 23rd January 1897 :—

Mr. F B. Manson, Deputy Conservator of Forests of the 2nd grade, to officiate in the 1st grade of Deputy Conservators.

Mr. W. M. Green, Deputy Conservator of Forests of the 3rd grade to officiate in the 2nd grade of Deputy Conservators

Mr. F. Traford, Assistant Conservator of Forests of the 1st grade (provisional), to officiate in the 4th grade of Deputy Conservators.

Mr. W. F. Perreé. Assistant Conservator of Forests of the 2nd grade' to officiate in the 1st grade of Assistant Conservators.

5.—N.-W. P. AND OUDH GAZETTE.

7*th May* 1897.—No. $\frac{1239}{\text{II-155C.}}$ Notification No. $\frac{996}{\text{II-155C.}}$ dated the 13th April, 1897, posting Sirdar Bahadur Hira Singh, Extra Assistant Conservator of Forests to the Naini Tal Division of the Central Forest Circle, is hereby concelled.

7*th May* 1897 No $\frac{1242}{\text{II-665B.}}$ With effect from the 1st March 1897 the date on which Mr. B B. Osmaston, Deputy Conservator of Forests, 4th Grade, *provisional* substantive, took charge of the office of Instructor at the Forest School, Dehra Dun, Mr. W- H. Lovegrove, Assistant Conservator of Forests, 1st grade, to be Deputy Conservator of Forests 4th grade, *provisional* substantive.

6.—PUNJAB GAZETTE.

3*rd May* 2897 —No. 245.—Lala Daulat Ram, Extra Assistant Conservator of Forests, was relieved of his duties in the Kangra Division on the afternoon of the 17th April 1897 and transferred to the Lahore Division, where he joined on the forenoon of the 19th idem.

22*nd May* 1897.—No. 373.—Lala Jowala Parshad, and Mr. C. F. Rossiter, Extra Assistant Conservators of Forests, respectively made over and received charge of the Mooltan Forest Division at Jhelum on the afternoon of the 24th April 1897, and respectively received and delivered over charge of the Jhelum Forest Division at Jhelum on the 26th April 1897.

Mr. Rossiter held charge of both Divisions during the period comprised between the dates mentioned above.

7.—CENTRAL PROVINCES GAZETTE.

27th April 1897.—No. 4—Mr. S. N. Chatterji, Forest Ranger, attached to the Mandla Division, is transferred on special duty to the Betul Forest Division, in order to complete the demarcation of the areas excised for ryotwari settlement from the Reserved Forests of the Dabka and Tapti Ranges.

Mr. Muhammad Yasin, Forest Ranger, attached to the Saugor Forest Division, is transferred to the Mandla Forest Division.

3rd May 1897.—No. 2314—Mr. C. O. Hanson, Assistant Conservator of Forests, returned from the three months' privilege leave granted him by Order No. 66 of the 7th January 1897, and reported himself for duty at Nagpur on the forenoon of the 26th April 1897.

6th May 1897—No. 2376—With reference to Order No 720, dated the 6th February 1897, Messrs F. Linnell, Officiating Deputy Conservator of Forests, and C. M. McCrie, Assistant Conservator of Forests, assumed charge of their special famine duties at Jubbulpore respectively on the 17th and 3rd idem.

6th May 1897.—In consequence of the resignation of his appointment tendered by D. Raja Rao, Forest Ranger, 4th grade, attached to the Balaghat Forest Division, in the Southern Circle, the following promotions among Forest Rangers in the Central Provinces are ordered with effect from the 18th April 1897:—

Mathura Pershad, Forest Ranger, 4th grade, sub *pro tem.*' in the Southern Circle, is confirmed in that grade, *vice* D. Raja Rao, resigned.

Dinker Vishnu Pranjpe, Forest Ranger, 5th grade, in the Southern Circle, to be Forest Ranger, 4th grade, sub-*pro tem*, *vice* Mathura Pershad, confirmed.

Chintaman Vishwanath,, Forest Ranger, 5th grade, sub. *pro tem.*, in the Northern Circle, to be Forest Ranger, 5th grade, *vice* Dinker Vishnu promoted.

Mr. N. G. Slaney, Forest Ranger, 6th grade, in the Southern Circle, to be Forest Ranger, 5th grade, sub. *pro tem.*, *vice* Chintaman Vishwanath, confirmed.

14th May 1897.—No. 1—Consequent on the transfer of Mr. R O. Pinder, Forest Ranger, 5th grade, to Burma, the following promotions among Forest Rangers in the Central Provinces are ordered with effect from the 1st February 1897.

Mr. R. N. Thompson, Officiating Forest Ranger, 5th grade, attached to the Northern Circle, to be Forest Ranger, 5th grade, *vice* Mr. Pinder, transferred.

Mr. Dinker Vishnu Paranjpe, Forest Ranger, 6th grade, sub *pro tem*, attached to the Chanda Forest Division, to be Forest Ranger, 6th grade, *vice* Mr. Thompson, promoted.

Mr. Vinayak Chimnaji, Temporary Forest Ranger, attached to the Northern Circle, to be Forest Ranger, 6th grade, sub *pro tem*, on the permanent establishment, *vice* Mr. Dinker Vishnu Paranjpe, confirmed in that grade.

14th May 1897.—No. 2.—Consequent on the return to duty from six months' leave on medical certificate of Mr. Muhammad Yasin, Forest Ranger, 3rd grade, attached to the Northern Circle, the following reversions among Forest Rangers in the Central Provinces are ordered with effect from the 7th March 1897 :—

Mr. A. Ponnuswamy, Officiating Forest Ranger. 3rd grade, to be Forest Ranger, 4th grade.

Mr. J F. Anthony, Officiating Forest Ranger, 4th grade, to be Ranger, 5th grade.

Mr. D. Raja Rao, Officiating Forest Ranger, 5th grade, to be Forest Ranger, 6th grade.

14th May 1897.—Consequent on the return of Mr. Nago Rao, Forest Ranger, 3rd grade, from his deputation on Foreign Service, the following reversions among the Forest Rangers in the Central Provinces are ordered with effect from the 18th January 1897 :—

Mr. Ganga Pershad, Forest Ranger, 3rd grade, attached to the Southern Circle, to be Forest Ranger, 3rd grade sub. *pro tem.*

Mr Shama Rao, Forest Ranger, 3rd grade, sub. *pro tem*, attached to the Southern Circle, to be Forest Ranger, 4th grade.

Mr. Chhoga Lal, Forest Ranger 4th grade, sub. *pro tem.*, attached to the Southern Circle, to officiate as Forest Ranger, 4th grade.

20th May 1897—No 2640—Mr. A. M F. Caccia, Provisional Deputy Conservator of Forests, reported his departure from Bombay on furlough per P. & O. S.S. *Britannia* on the afternoon of the 1st instant.

20th May 1897.—No 3941.—With reference to Order No. 2552, dated the 29th ultimo, Mr. C M. McCrie, Assistant Conservator of Forests, assumed charge of the Mandla Forest Division, from the Deputy Commissioner, Mandla, on the afternoon of the 6th instant.

20th May 1897.—No. 2651.—With reference to Order No. 2481, dated the 13th instant, Mr. C O. Hanson, Assistant Conservator of Forests, assumed charge of the Seoni Forest Division, from Mr. Narain Pershad, Forest Ranger, on the afternoon of the 6th idem.

20th May 1897.—No. 2652.—With reference to Order No. 2482, dated the 13th instant, Mr Narain Pershad, Forest Ranger, reverted to his substantive appointment as Working-Plans Assistant in the Seoni Forest Division with effect from the 7th idem.

27th May 1897.—No. 2709.—Mr. D. O Witt, Assistant Conservator of Forests, Mandla, availed himself, on the afternoon of the 26th ultimo, of subsidiary leave preparatory to furlough on medical certificate for one year granted him by Order No 2478, dated the 13th instant.

Mr. Witt, reported his departure from Bombay per P. & O. S. S. *Britannia* on the afternoon of the 1st idem.

8.—BURMA GAZETTE.

5th May 1897.—No. 13.—In continuation of office Notification No. 11, dated the 22nd April 1897, Mr. R. P. Kelly, Forest Ranger, 3rd grade, assumed charge of the Myanaung subdivision on the forenoon of the 18th April 1897.

6th May 1897.—No 11. (Corrigendum)—In this office No. 10, dated the 26th April 1897, *for* the words and figures "1st January 1897" *read* "31st January 1897.

7th May 1197—No 6.—Mr E. C Florey, Forest Ranger, was granted two months' privilege leave, in additton to the leave granted in this office Notification No. 27. dated the 31st December 1896.

10th May 1897.—No. 171 Mr. A. Weston, Deputy Conservator of Forests has been granted by Her Majesty's Secretary of State for India an extension of furlough for six months.

No. 7.—With reference to Notification No. 144 (Forests), dated the 20th April 1837, Mr. H. Calthrop, Deputy Conservator of Forests, made over, and Mr. J. N. Thurston, Deputy Commissioner, received charge of the South Tenasserim division on the afternoon of the 5th May 1897.

11th May 1897.—No. 8.—Mr. E C. Florey, Forest Ranger, 3rd grade, is granted sick leave from the 19th March to the 27th April 1897 and leave without allowances for six months from the 28th April 1897.

11th May 1897.—No 174.—Under the provisions of Articles 277 and 291 of the Civil Service Regulation privilege leave for two months and 24 days is granted to Mr. H Calthrop, Deputy Conservator of Forests.

Mr Calthrop is permitted to overstay his leave by 15 days under Article 282 (*a*) (ii) of the Civil Service Regulations.

11th May 1897.—No. 175.—The following transfers are ordered in the Forest Department :—

Mr. G. K. Parker, Assistant Conservator of Forests, from Kindat to the charge of the Paungbyin Forest subdivision.

Mr. J. G. F. Marshall, Extra Deputy Corservator of Forests, from Mingin to the charge of the South Tenasserim Forest division.

Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, from from Homalin to the charge of the Myitha Forest division.

This department Notification No. 144, dated the 20th April 1897, is hereby cancelled.

13th May 1897.—No. 9.—With reference to Revenue Department Notification No 137 (Forests), dated the 9th April 1897, Mr. W. T. T. McHarg, Deputy Conservator of Forests, made over, and Mr. C. E, Muriel, Deputy Conservator of Forests, received, charge of the Minbu and Magwe divisions on the forenoon of the 29th April 1897.

13th May 1897.—No 178.—Mr S. Carr, officiating Deputy Conservator of Forests, in charge Working Plans Division, Upper Burma, is posted to the charge of the Lower Chindwin Division, in addition to his other duties, *vice* Mr. Hobart-Hampden, proceeding on leave.

17th May 1897.—No. 10.—With reference to Revenue Department Notification No. 115 (Forests), dated the 30th March 1897, Mr. C. B, Smales, officiating Deputy Conservator of Forests, made over, and Mr. H H, Forteath Deputy Conservator of Forests, received, charge of the Gangaw subdivision, Yaw division, on the afternoon of the 6th May 1897.

No. 11,—With reference to Revenue Department Notifications Nos. 114 and 115 (Forests), dated the 30th March 1897, Mr. C. R. Dun, Deputy Conservator of Forests, made over, and Mr. C. B. Smales, officiating Deputy Conservator of Forests, received, charge of the Mu division on the afternoon of the 10th May 1887.

No. 12.—Mr. C R. Dun, Deputy Conservator of Forests, availed himself of the furlough granted in Revenue Department Notification No. 114 (Forests), dated the 30th March 1897, on the afternoon of the 10th May 1897

20th May 1897.—No. 12 —With reference to Revenue Department Notification No 11 (Forests) dated the 22nd April 1897, Mr. W. H. Craddock, Supernumerary Extra Assistant Conservator of Forests, made over charge of the Kyauksè subdivision to Mr J Copeland, Deputy Conservator of Forests, Mandalay Division, on the forenoon of the 30th April 1897, and was placed on general duty at Maymyo from the same date

22nd May 1897 —No 14 —With reference to Revenue Department Notification No 137 (Forests) dated the 9th April 1897, Mr H. B. Ward, Deputy Conservator of Forests made over, and Mr W. T T. McHarg, Deputy Conservator of Forests received charge of the Rangoon and Pegu Divisions on the forenoon of the 5th May 1897

22nd May 1897 —No 186 —The following postings and transfers are ordered in the Forest Department —

- Mr C W Doveton, Assistant Conservator of Forests, from the Yamethin subdivision of the Pyinmana forest division to the charge of the Kyauksè subdivision of the Mandalay forest division.
- Mr. W A Hearsey, Extra Assistant Conservator of Forests, from the Mogôk subdivision of the Ruby Mines forest division to the charge of the Bhamo forest division, *vice* Mr E S Carr, proceeding on leave
- Mr C S Rogers Extra Assistant Conservator of Forests, to the charge of the Mogôk subdivision of the Ruby Mines forest division in addition to his other duties
- Mr W. H. Craddock, Extra Assistant Conservator of Forests, from the Mandalay forest division to the Pyinmana forest division.

25th May 1897 —No 188.—Under the provisions of Article 343 of the Civil Service Regulations furlough on medical certificate for one year is granted to Mr. C. H Hobart-Hampden, Deputy Conservator of Forests with effect from the date on which he may avail himself

27th May 1897 —No 189 —Under the provisions of Article 343 of the Civil Service Regulations leave on medical certificate for one year is granted to Mr D. H. Allan, Extra Assistant Conservator of Forests with effect from the date on which he may avail himself of it.

3 *st May* 1897 —No, 191 —Under the provisions of Articles 291 and 282 (*a*) (*i*) of the Civil Service Regulations privilege leave for three months and 15 days is granted to Mr E S Carr, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

9—ASSAM GAZETTE.

31st May 1897 —No. 396IG —Mr J C Carroll Assistant Conservator of Forests, attached to the Goalpara Forest Division, is placed on special duty and attached to the office of the Conservator of Forests, Assam,

10—HYDERABAD RESIDENCY GAZETTE.

Nil.

11.—MYSORE GAZETTE.

3rd May 1897 —No. 9706—Ft F. 1-95 —Under Article 172 of the Mysore Service Regulations, Mr A G R Theobold Sub Assistant Conservator of Forests, Mysore district, is granted casual leave of absence for fifteen days, with effect from the 8th April 1897

12th May 1897 —No 10086—Ft F 7 96 —In Notification No. 7236—Ft F 7-96, dated 11th February 1897, granting three days' casual leave to Mr. J J Monteiro, then officiating Assistant Conservator of Forests, Shimoga district, *for* "8th February" *read* ' 8th January "

13th May 1897.—No 10098—Ft F. 119-95 —Under Article 171 of the Mysore Service Regulations, Mr. H Muttappa, Assistant Conservator of Forests, Bangalore district is granted casual leave of absence for five days from the 10th instant, or from such other date as he may avail himself of the same

21st May 1897 —No. 10318—Ft F 43-96 —Under Article 171 of the Mysore Service Regulations, Mr H Srinivasa Rao, Acting Sub-Assistant Conservator of Forests, Mysore district, was granted a day's casual leave on the 28th April, 1897

VIII--EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

9th June 1897 —No. 524—102 9-F —*Erratum* —In the notification of this Department No. 397-F, dated the 30th April last, regarding Mr. Dickinson's furlough, *for* "18th April 1897" *read* "17th April 1897" in the first clause, and "afternoon of 17th April 1897" in the second clause.

No, 527—107-9-F —With reference to the notification of this Department No. 322-F., dated the 19th March last, the services of Mr. E. M. Coventry, Assistant Conservator of Forests, 1st grade, North-Western Provinces and Oudh, are placed at the disposal of the Government of the Punjab, with effect from the 1st July next.

16th June 1897—No 573—188-1 F.—*Erratum.* In the notification of this Department No 756-F, dated the 7th August 1896, granting furlough for fifteen months to Mr. J S. Gamble, Conservator of Forests and the Director of the Imperial Forest School, *substitute* the following for the second clause of that notification as regards entries (i) and (v).

The following arrangements are made in consequence of Mr Gamble proceeding on leave :

(i) Mr. J. W. Oliver, Conservator, 2nd grade, Eastern Circle, Upper Burma—to officiate as Conservator, 1st grade, and to be in charge of the School Circle and Director of the Imperial Forest School, with effect from the 1st August, 1896

. . . .

(v) Mr. F Gleadow, Deputy Conservator. 3rd grade, Bombay—to be Deputy Director of the Imperial Forest School, with effect from the 28th June, 1896. From the same date Mr Smythies reverted to the North-Western Provinces and Oudh list.

2—Madras Gazette.

4th June 1897.—No. 228.—Mr. P. M. Lushington, District Forest Officer, Coimbatore (North), is granted privilege leave for 2 months and 29 days, with effect from or after the 23rd instant under article 291 of the Civil Service Regulations.

5th June 1897.—No. 234.—

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.,
1	Mr. A. W. Lushington ...	Deputy Conservator of Forests 3rd Grade	Deputy Conservator of Forests, 1st Grade.	Acting ..	To continue until Mr. Brasier's return from leave, or until further orders.
2	Mr. E. R. Murray ...	Do.	Deputy Conservator of Forests, 2nd Grade.	Do.	
3	Mr. H. B. Bryant ...	Deputy Conservator of Forests, 4th Grade.	Deputy Conservator of Forests, 3rd Grade.	Do.	
4	Mr. W. W. Batchelor ..	Assistant Conservator of Forests, 2nd Grade, and acting in the 1st Grade.	Deputy Conservator of Forest, 4th Grade.	Do.	Until Mr. Foulkes returns from deputation.
5	Mr. H. Tireman ..	Assistant Conservator of Forests, 1st Grade.	Do.	Do.	From the date of Mr. Foulkes' return to duty.

NOTE.—The above appointments are made in consequence of Mr. Stanbrough's absence on furlough.

6	Mr. P. M. Lushington ...	Deputy Conservator of Forests, 3rd Grade.	Deputy Conservator of Forests, 2nd Grade.	Acting ...	During the absence of Mr. Lodge on privilege leave, or until further orders.
7	Mr. W. W. Batchelor ...	Assistant Conservator of Forests, 2nd Grade, and acting 1st Grade.	Deputy Conservator of Forests, 4th Grade.	Do.	From the date of Mr. Foulkes' return from deputation.

9th June, 1897,—No. 231 —

No.	Name of Officer.	District	Nature of charge	Remarks
1	Mr. J. L. MacC O'Leary.	Ganjam .	District Forest Officer (Permanent)	To take effect on the completion of his special duty in the district.
2	,, R. McIntosh, M. A.	Cuddapah	Ditto	
3	,, F. Foulkes	Nellore	Ditto	
4	,, W. W. Batchelor	Cuddapah		To do duty under the supervision of the District Forest Officer.

10th June 1897 —*Appointment and Posting* —V. R. Venkataramiah, D.D.R., is appointed as Forest Ranger, VI Grade, on probation for six months and is posted to the Kurnool district. To take effect from date of joining.

18th June 1897 —264.—

No.	Name of Officer,	District	Nature of charge	Remarks
..	Mr C. J. Wontersz, Extra Assistant Conservator of Forests, 3rd grade	North Coimbatore	Acting District Forest Officer.	During the absence of Mr P. M. Lushington on privilege leave, or until further orders

18th June 1897.—*Transfer*.—A. Srinivasa Chamberlain, Ranger, VI Grade, is transferred from Tinnevelly to South Coimbatore temporarily.

23rd June 1897 —*Extension of Leave* – The two months' privilege leave granted in service order No. 192 of 1896-97 to Ranger Mr C. P. Howell, North Coimbatore Division, extended by thirteen days.

26th June 1897.—*Transfers* —The following transfers are ordered :—

Ranger J. A. Daly from the Trichinopoly district to the Salem district.

Ranger A. N. Venkatachallam from the Salem district, to the Trichinopoly district—to join.

29th June 1897.—*Leave* —S. Ramaswami Ayah, Forest Ranger, Salem district, is granted fifteen days' leave upon urgent private affairs, under article 370 of the Civil Service Regulations, from date of relief or 1st July 1897.

3.—BOMBAY GAZETTE.

9th June 1897.—No. 4332.—Mr C Greatheed, Deputy Conservator of Forests, Second Grade, has been allowed by Her Majesty's Secretary of State for India an extension of furlough on medical certificate for four months

12th June 1897 —No 4455 --His Excellency the Governor in Council is pleased to appoint Mr Chunilal Gulabchand Dalia, L C.E., to hold charge of the office of Divisional Forest Officer, Surat, from the date on which Mr A Stewart gives over charge pending further orders

24th June 1827 —No 866 —Mr A. Stewart, Deputy Conservator of Forests, Third Grade, delivered over and Mr C G Dalia, L C E. Extra Assistant Conservator of Forests, Fourth Grade, received charge of the Divisional Forest Office, Surat, on 22nd June 1897, after office hours,

4.—BENGAL GAZETTE.

9th June 1897.—No 504T R.—Mr, J P Haslett, Extra Assistant Conservator of Forests, is granted leave, under Articles 277 and 291 of the Civil Service Regulations, for three months, with effect from the 15th June 1897.

10th June 1897 —No 525T R —Mr W F, Perreé, Assistant Conservator of Forests 2nd grade is promoted to officiate in the 1st grade of Assistant Conservators from the 11th November, to the 29th December, 1896, both days inclusive.

10th June 1897 —No 526T A —Mr H A Farrington, Assistant Conservator of Forests, 2nd grade, is promoted to officiate in the 1st grade of Assistant Conservators of Forests from the 11th November to the 11th December, 1896 both days inclusive

12th June 1897.—No 567T R —The following reversions are ordered, with effect from the 17th May 1897, in consequence of the return to Bengal of Mr, E G Chester, Deputy Conservator of Forests, 1st grade, from Assam :—

Mr F B. Manson, Officiating Deputy Conservator of Forests, 1st grade, to the 2nd grade of Deputy Conservators

Mr. W. M Green, Officiating Deputy Conservator of Forests, 2nd grade, to the 3rd grade of Deputy Conservators

Mr H D. D. French Officiating Deputy Conservator of Forests, 3rd grade, to the 4th grade of Deputy Conservators

Mr. E P Stebbing Officiating Deputy Conservator of Forests, 4th grade, to Assistant Conservator of Forests, 1st grade, sub *pro tem.*

Mr H A Farrington, Officiating Assistant Conservator of Forests, 1st grade, to the 2nd grade of Assistant Conservators

12th June 1897 —No 568T.R.—Mr. E G. Chester, Deputy Conservator of Forests, 1st grade, is, on return from Assam, posted to the charge of the Singhbhum Forest Division.

Mr. E P. Stebbing, Assistant Conservator of Forests, 1st grade sub *pro tem*, on being relieved of the charge of the Singhbhum Forest Division by Mr Chester, is attached to that Division until further orders.

12th June 2197 —No, 569T R-—Mr. H H Haines, F C.H., Deputy Conservator of Forests, 4th grade, having availed himself of the eight months' furlough granted him in Notification No. 1747 For., dated 8th May 1887, with effect from the 27th April 1897, the following temporary promotions are made :—

Mr. E P. Stebbing, Assistant Conservator of Forests, 1st grade, sub. *pro tem*, to officiate in the 4th grade of Deputy Conservators.

Mr H. A Farrington, Assistant Conservator of Forests, 2nd grade, to officiate in the 1st grade of Assistant Conservators of Forests.

12th June 1897.—Mr. 635T.R —Mr. R. Quinnell, Extra Assistant Conservator of Forests, is granted furlough for one year, under article 871 *(a)* of the Civil Service Regulations, with effect from the 15th June 1897.

12th June 1897.—No. 671T.R —Forty-two days' privilege leave, under article 291 of the Civil Service Regulations, is granted to Mr. C, C. Hatt, Officiating Deputy Conservator of Forests, 4th grade, in charge of the Puri Division, with effect from the 13th June 1897.

Mr. F E Slane Extra-Assistant Conservator of Forests, 3rd grade, in charge of the Angul Division, is posted temporarily to the charge of the Puri Division, in addition to his other duties, during the absence, on leave, of Mr. Hatt, or until further orders.

5.—N.-W. P. AND OUDH GAZETTE.

14th June 1897.—No $\frac{1485}{II-682c}$ Mr. R. C. Milward, Assistant Conservator of Forests, attached to the Naini Tal Division of the Central Forest Circle, to the charge of the Kumaun Division of the same Circle, *vice* Mr. E M. Coventry, retransferred to the Punjab.

No. $\frac{1503}{II-86A.}$ With effect from the 6th March, 1897, the date on which Mr, B. A Rebsch proceeded on leave :—

Mr. B B. Osmaston, Deputy Conservator of Forests, 4th Grade, provisional substantive, on deputation as Instructor at the Forest School, to officiate as Deputy Conservator of Forests, 3rd grade.

No. $\frac{1504}{II-68A}$ With effect from the 10th April, 1897, Mr. R. C. Milward, Assistant Conservator of Forests 2nd grade. to Officiate as Assistant Conservator of Forests, 1st grade. to fill an existing vacancy.

6.—PUNJAB GAZETTE.

5th June 1897.—*Erratum* —In Notification No. $\frac{225}{A\ L\ \ No\ 14.}$, dated 27th April 1897. *for* " Mr. F. Linnell " *substitute* "Mr C. O. Hanson."

25th June 1897.—No. $\frac{285}{\text{A L. No. 16.}}$—The following changes have taken place in the list of Forest Officers in the Associated Province with effect from the dates specified against each :—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from	REMARKS.
Mr. F. Linnell	Assistant Conservator, 1st Grade.	Offg. Deputy Conservator, 4th Grade,	15th March	Consequent on Mr. E. M. Coventry's temporary transfer to North-Western Provinces.
Mr. B. O Coventry ..	Ditto	Ditto.	17th April .	Consequent on Mr. Hanson's promotion to Officiating Deputy Conservator, 4th Grade, while on privilege leave.
Mr. B. O. Coventry ..	Offg. Deputy Conservator, 4th Grade.	Assistant Conservator, 1st Grade.	20th April ..	Consequent on the return of Mr. Hanson from privilege leave.
Mr. B. O. Coventry	Asst. Conservator, 1st Grade.	Offg Deputy Conservator 4th Grade,	1st May .	Consequent on the departure of Mr Caccia on six months' leave on medica Certificate.

7.—CENTRAL PROVINCES GAZETTE.

29th April 1897.—No 2250.—Furlough on medical certificate for six months, under Article 340 (*a*) of the Civil Service Regulations, is granted to Mr. A. M F. Caccia, Officiating Deputy Conservator of Forests, Mandla Forest Division, with effect from the 25th instant, or the subsequent date on which he may avail himself of it.

3rd June 1897.—No. 5.—The services of Bhagwant Rao, Forest Ranger, Nimar Forest Division, are temporarily placed at the disposal of the Deputy Conservator of Forests, Hoshangabad Forest Division, for employment on the construction of the ghat section of the Borda-Nandwara Road in the Hoshangabad District.

Bhagwant Rao reported himself to the Deputy Censervator of Forests, Hoshangabad, on the forenoon of the 24th May, 1897, for duty.

8th June 1897.—No. 2881.—With reference to Order No. 2,190, dated the 27th April, last, Mr. R. S. Hole, Assistant Conservator of Forests, relinquished charge of his duties in the Hoshangabad Forest Division, on the afternoon of the 14th ultimo, and assumed charge of his duties in the Direction Division at Jubbulpore on the forenoon of the 25th idem.

8.—BURMA GAZETTE

7th June 1897 —No 14 —With reference to Revenue Department Notification No 188 (Forests) dated the 25th May, 1897, Mr C H Hobart Hampden, Deputy Conservator of Forests made over charge of the Lower Chindwin Division to Lieutenant Colonel T M Jenkins, Deputy-Commissioner, on the afternoon of the 17th May 1897, and availed himself of the furlough for one year granted him in the above notification

„ No. 15 —With reference to Revenue Department Notification No. 178 (Forests), dated the 13th May, 1897, S. Carr, officiating Deputy Conservator of Forests, received charge of the Lower Chindwin division from Lieutenant-Colonel T. M Jenkins, Deputy Commissioner, on the 21st May, 1897

8th June 1897 —No 16 —With reference to Revenue Department Notification No 189 (Forests), dated the 27th May, 1897, Mr D H Allan, Extra Assistant Conservator of Forests, made over charge of his duties in the Magwe division to Mr C E Muriel, Deputy Conservator of Forests, on the forenoon of the 24th May, 1897, and availed himself of the one year's furlough granted in the above notification

11th June 1897 —No 15 — Mr P W Healy, Extra Assistant Conservator of Forests, received charge of the South Tharrawaddy sub-division on the afternoon of the 5th June 1897

16th June 1897 —No 207,—Mr J Messer Deputy Conservator of Forests, has been granted by Her Majesty's Secretary of State for India an extension of leave for four months on medical certificate

16th June 1897 —No 208 —Mr J W Ryan, Extra Assistant Conservator of Forests is transferred from Toungoo to the Kado division

16th June 1897 —No 209 —The following promotions are ordered in the Forests Department,—

(1) With effect from the 2nd April 1897, consequent on the deputation of Mr. W F L Tottanham to Siam —

Mr C. R Dun, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade

Mr S Carr, F.C.H., Assistant Conservator 1st grade, to be Deputy Conservator, 4th grade, provisionally substantive

(2) With effect from the 6th May, 1897, consequent on the departure on leave of Mr H. Calthrop, Deputy Conservator of Forests :

Mr. A F. Gradon, Deputy Conservator, 3rd grade, ***seconded***, to officiate as Deputy Conservator, 2nd grade.

Mr G Q Corbett, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade

Mr. G R Long, Deputy Conservator, 4th grade, provisionally substantive, to officiate as Deputy Conservator, 3rd grade.

(3) With effect from the 11th May, 1897, consequent on the departure on leave of Mr C R Dun, Deputy Conservator :

Mr A M. Burn-Murdoch, Deputy Conservator, 4th grade, provisionally substantive, to officiate as Deputy Conservator, 3rd grade

(4) With effect from the 18th May, 1897, consequent on the departure on furlough of Mr. C H. Hobart-Hampden, Deputy Conservator 3rd grade :

Mr. M. Hill, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. S. Carr, Deputy Conservator, 4th grade, provisionally substantive, to officiate as Deputy Conservator, 3rd grade

16th June 1897.—No. 13.—With reference to Revenue Department Notification No. 186 (Forests), dated the 22nd May, 1897, Mr. W. Hearsey, Extra Assistant Conservator of Forests, made over, and Mr. C. S. Rogers, Extra Assistant Conservator of Forests, received, charge of the Mogok subdivision, of the Ruby Mines district, on the afternoon of the 4th instant, in addition to his other duties.

18th June 1897 —No. 17.– Consequent on the promotion of Messrs. R. L. Pocock and W. H. Craddock as Supernumerary Extra Assistant Conservators of Forests, the following appointments and promotions are made in this circle :—

With effect from the 31st January, 1897, Mr. G. T. Wrafter, temporary Ranger, to be Ranger, 3rd grade, on the permanent establishment

With effect from the 1st March, 1897, Mr. G. T Wrafter, Ranger, 3rd grade, to be Ranger, 2nd grade.

19th June 8897 —No. 18.—With reference to Revenue Department Notification No. 175 (Forests), dated the 11th May, 1897, Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, received, charge of the Myttha Forest Division on the afternoon of the 10th June.

No. 19.—With reference to Revenue Department Notification No. 175 (Forests), dated the 11th May, 1897, Mr. R M. Kavanagh, Extra Assistant Conservator of Forests, made over, and Mr. G. K Parker, Assistant Conservator of Forests, received of the Paungbyin subdivision, Upper Chindwin Forest Division, on the forenoon of the 2nd June, 1897.

24th June 1897 —No 216.—Mr. A M. Buchanan, Extra Deputy Conservator of Forests, is posted to the charge of the Myttha Forest division, Western Circle, *vice* Mr. Kavanagh, transferred to Port Blair.

25th June 1897 —No. 20 —*For* the words "one year's furlough" in this office Notification No 16, dated the 8th June, 1897, *read* "leave on medical certificate for one year."

28th June 1817 —No 14 —With reference to Revenue Department Notification No. 191 (Forests, dated the 31st May, 1897, Mr. E S. Carr, Deputy Conservator of Forests, made over charge of the Bhamo Forest, division to Mr. W. A. Hearsey, Extra Assistant Conservator of Forests, and availed himself of the three months and 15 days' privilege leave granted him in the notification quoted above, on the afternoon of the 15th instant.

9.—ASSAM GAZETTE.

3rd June 1897.—No. 4091G.—Furlough for seventeen months, unde article 340 (*b*) of the Civil Service Regulations, is granted to Mr. J. E Barrett, Deputy Conservator of Forests, Cachar Division, with effect from the 23rd June, 1897 or the subsequent date on which he may avail himself of it.

3rd June 189 .—No. 4092G.—The following transfers of officers in the Forest Department are ordered :—

Mr. H. S. Ker-Edie, M.A., Officiating Deputy Conservator of Forests from the Kamrup Division to the charge of the Cachar Forest Division.

Mr. F. E. B. Lloyd, Officiating Deputy Conservator of Forests, from the Sibsagar Division to the charge of the Kamrup Forest Division,

Babu Nilkanta Mukharji, Forest Ranger, from the Central Range, Darrang Division, to the charge of the Sibsagar Forest Division.

11*th June* 1897.—No. 431 G.—On the report of the Central Examination Committee, the Chief Commissioner directs the publication, for general information, of the results of the Half-yearly Examination of Assistant Commissioner, Extra Assistant Commissioners, and other officers, held on the 10th, 11th, 12th, 13th, and 14th, May 1897 :

Name:	Subjects taken by candidates.		Subject in which passed		Subject in which still required to pass.	
	Higher Standard.	Lower Standard.	Higher Standard.	Lower Standard.	Higher Standard	Lower Standard
Assistant Conservator of Forests. Mr. A. R. Dicks.	Bengali.	Bengali.	Bengali.	Bengali.		

10.—HYDERABAD RESIDENCY GAZETTE.

Nil *Nil.*

11.—MYSORE GAZETTE.

15*th June* 1897.—No. 10868—*Ft. F.* 91-95.—Under Article 171 of the Mysore Service Regulations, Mr. B. Srinivasa Rao, Assistant Conservatorof Forests, Mysore district, was granted casual leave of absence for three days, with effect from the 24th April, 1897.

15*th June* 1897.—No. 10871—*Ft. F.* 46-96—Under Article 188 of the Mysore Service Regulations, Mr. B. Hira Singh, Assistant Conservator of Forests, Kadur District, is granted privilege leave of absence for one month and a half, with effect from such date as he may avail himself of the same.

Mr. Y. Sitaramaiya, Assistant Conservator of Forests, on special duty in the Kadur District, will in addition to his own duties, be in charge of the district Forest Office during the absence of Mr. B Hira Singh on leave or until further orders.

15*th June* 1897.—No. 10874--Under Article 188 of the Mysore Service Regulations, Mr. A. G. R. Theobald, Sub-Assistant Conservator of Forests, Mysore district, is granted privilege leave of absence for one month and a half in extension of the fifteen days casual leave granted to him in Government Notification No. 9706—Ft. F. 1.95, dated 3rd May, 1897, which will be now be commuted into privilege leave.

Mr. B. Srinivasa Rao, Assistant Conservator of Forests will be in charge of the Sargur Range, in addition to his own duties as Acting Range Officer, of Kakankote Range, during Mr. Theobald's absence on leave or until further orders.

15*th June* 1897.—No. 10877.—*Ft. F.* 64-95—Under Article 188 of the Mysore Service Regulations, Mr. M. Venkatanaranappa Assistant Conservator of Forests, Tumkur district, was granted privilege leave of absence for fifteen days, with effect from the 20th May, 1897.

15*th June* 1897.—No. 10880—*Ft. F.* 89·95—Under Article 172 of the Mysore Service Regulations, Mr. K. Shamaiengar, Sub-Assistant Conservator of Forests Chitaldrug 'District. is granted casual leave of absence for two weeks, with effect from the 14th June, 1897 or such other date as he may avail himself of the same.

15*th June*, 1897.—No. 10883-*Ft F.* 119-59.—Under Article 188 of the Mysore Service Regulations, Mr. H. Muthappa Assistant Conservator of Forests, Bangalore district, is granted privilege leave of absence for one month from the 10th June 1897, of from date of relief.

Mr. G. E. Ricketts, Assistant Conservator of Forests on special duty will, in addition to his own duties, be in charge of the Bangalore District Forest Office during M. Mutthappa's absence on leave, or until further orders.

VIII--EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

2nd July 1897 —No. 634—156-4-F.—Mr. C F Elliott, Conservator of Forests, 3rd (officiating 2nd) grade, in charge of the Punjab Forest Circle, is granted privilege leave for three months, under articles 277 and 291 of the Civil Service Regulations, with effect from the afternoon of the 22nd June 1897.

Mr G. G Minniken, Deputy Conservator, 1st grade, Punjab, is appointed to officiate as Conservator, 3rd grade, and to be in charge of the Punjab Forest Circle, during Mr. Elliott's absence, or until further orders.

2—MADRAS GAZETTE

5th July 1897 —*Promotion* —The following promotions in the Ranger's class of the Southern Circle are ordered with effect from 1st April, 1897 :—

	Name.	Present grade.	Rs	Grade to which promoted.	Rs.
1	N M Rego	Ranger, 4th grade,	on 80	Ranger, 3rd grade,	on 100
2	E C M. Mascurenhas .	Do 5th do	on 60	Do 4th do	on 80
3	A F. X Saldanah	Do 5th do	on 60	Do 4th do	on 80
4.	K Narayanaswami Iyar	Do 6th do	on 50	Do 5th do	on 60
5.	M. Panchapikesa Iyer	Do 6th do	on 50	Do 5th do	on 60

8th July 1897 —*Privilege Leave.*—To G. W. Thompson, Ranger, 5th Grade, North Arcot district, for two months under article 291 of the Civil Service Regulations from 10th June, 1897.

9th July 1897 —*Privilege Leave.*—To C. M. Maduranayagam Pillai, Ranger, 1st Grade, South Arcot district, for two months and fifteen days under article 291 of the Civil Service Regulations from 23rd June, 1897

10th July 1897.—*Promotions.*—The following promotions are ordered in the Ranger's class of the Northern Circle from 1st April, 1897.

M. R. Ry. V. Kalyanarama Iyer from 5th to 4th grade.
,, L. Hanumanthulu do. do.
,, S. Eggianarayana Sastri do. do.
,, L. S Kristnamachari from 6th to 5th grade.

10th July 1897.—*Gradations and Promotions* —The re organization of the subordinate staff having been sanctioned, the following gradations and promotions are ordered with effect from 1st January, 1897,

No.	Name.	Present grade.	Grade in the re-organisation.	Remarks.
1	Mr. H. J. McLaughlin ...	Forest Ranger, 1st Grade, on Rs. 125.	Forest Ranger, 2nd Grade, on Rs. 125.	
2	Mr W. R. Newman ...	Forest Ranger. 2nd Grade, on Rs. 100.	Forest Ranger, 3rd Grade, on Rs. 100.	
3	M. R. Ry. N. S. Veeracharlu...	Forest Ranger, 3rd Grade, on Rs. 80	Do do	
4	Do P. Ananda Row ...	Do do	Do do	
5	Do R. Venkatesa Mudaliar.	Forest Ranger, 5th Grade, on Rs. 50.	Forest Ranger, 5th Grade, on Rs. 60.	
6	Do M. Balaji Singh ...	Do do	Do do	On probation for 6 months.
7	Do K. Rama Row ...	Do do	Do do	
8	Do V. Kalyanarama Iyer	Do do	Do do	
9	Do L. Hanumantulu ..	Do do	Do do	
10	Do S. Eggianarayana Sastri.	Do do	Do do	
11	Do K. Aswatham Naidu	Do do	Do do	
12	Do N. S. Anantacharlu	Do do	Do do	
13	Do K. S. Kaistnamachari	Do do	Forest Ranger, 6th Grade, on Rs. 50.	
14	Do N. Swaminadha Iyer	Acting Forest Ranger, 5th Grade, on Rs. 50.	Do do	

Sub. *pro tem,*

10*th July* 1897.—Referring to Board's Proceedings. Forest Mis No. 639 of 1st July, 1897, the following acting promotions are ordered in the subordinate staff of the Northern Circle with effect from 1st July, 1897 subject to the conditions that—

(1) that they should revert to the Deputy Rangers' class when qualified men are available to take their places, and

(2) that they should cease to draw pay as Rangers if they are not actually holding range charge or are deputed for training to the Forest School.

No.	Name.	Present grade.	Grade to which promoted.	Remarks.
1	P. Ramaswamiah ...	Deputy Ranger, 1st Grade.	Forest Ranger, 6th Grade on Rs. 50.	
2	Alur Kistniah ..	Do do	Do	
3	G. Venkatapaty Naidu ...	Do do	Do	
4	T. V. Sakkoji Row ...	Do 2nd Grade	Do	
5	Sheik Rahámatulla Saib ..	Do do	Do	
6	A. N. Bhujanga Row ...	Do do	Do	

14th *July* 1897.—*Transfer* —Ranger Mr. C. P. Howell on return from privilege leave transferred from North to South Coimbatore.

Ootacamund, July 12, 1897.

No. 322.—Mr. H. J. A. Porter, Deputy Conservator of Forests, Madras, has been granted one week's extension of furlough by the Right Honourable the Secretary of State for India in continuation of the furlough notified (as notification No. 394) at page 1,083 of Part 1 of the *Fort St. George Gazette* dated 18th August, 1897.

Ootacamund, July 16, 1897.

No. 323.—Mr S. Cox. District Forest Officer, Vizagapatam, is granted privilege leave for three months with effect from or after the 2nd August, 1897, under article 291 of the Civil Service Regulations.

APPOINTMENTS.

No. 324.—

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. W. W. Batchelor	Assistant Conservator of Forests, 2nd Grade. and acting in the 1st Grade	Deputy Conservator of Forests, 4th Grade.	Acting ...	Until the return of Mr C. E. Brasier from furlough.
2	Mr. H. B. Bryant...	Deputy Conservator, 4th Grade and acting in the 3rd Grade.	Deputy Conservator of Forests, 3rd Grade.	Do ...	To take effect from the date of Mr. Brasier's return.
3	Mr. H. Tireman ..	Assistant Conservator, of Forests, 2nd Grade, and Acting Deputy Conservator, 4th Grade.	Deputy Conservator of Forests, 4th Grade.	Do ...	

Note.—The above appointments are made during the absence of Mr. P. M. Lushington on privilege leave.

POSTING.

16*th July*, 1897.—

No.	Name and designation of officer.	District	Nature of charge.	Remarks.
...	Mr. F. C. L. Cowley-Brown, Assistant Conservator of Forests, 1st Grade, and Acting Deputy Conservator of Forests, 4th Grade.	South Coimbatore.	...	To do duty under the supervision of the District Forest Officer. The appointment is to take effect from the date of relief by Mr. Braiser.

17*th July* 1897.—*Promotions.*—Ranger J. A. Daly, sub. *pro tem* 4th grade, to be permanent 4th grade with effect from 1st April, 1897.

Deputy Ranger K. G. Subba Row to be Ranger, 6th grade, sub. *pro tem*, *vice* J. Tapp on foreign service, with effect from 1st July, 1897.

20*th July* 1897.—*Leave.*—R Venkatesa Mudaliar, Forest Ranger, Godavari, is granted privilege leave for one month and fifteen days from the date of relief.

21*st July*, 1897.—No. 339.—

No.	Name of Officer.	District.	Nature of charge.	Remarks.
...	Mr. H. F. Arbuthnot, Assistant Conserva- of Forests, 2nd grade	Vizagapatam.	Acting District Forest Officer.	During the absence of Mr. S Cox on privilege leave.
...	Do.	Godavari	......	To do duty under the supervision of the District Forest Officer. To join on the expiry of his term as Acting District Forest Officer, Vizagapatam.

28*th July* 1897.—*Departmental Test*—At an examination held on the 15th April, 1897, the undermentioned subordinate passed the Departmental Test for appointment to the class of Deputy Ranger :—

M. Sabji Sahib, Forester, 2nd Grade, South Arcot district.

3.—BOMBAY GAZETTE.

3rd July 1897.—No. 1399 FAM.—His Excellency the Governor in Council is pleased to direct that the Honourable Mr. A. T. Shuttleworth, who resumed charge of his substantive appointment of Conservator of Forests, C. C., on the 7th June, 1897, after office hours, shall continue

until further orders to perform the duties in connection with the famine grass operations in addition to his duties as Conservator.

29th July 1897.—No. 5699.—His Excellency the Governor in Council is pleased to make the following appointments.

Mr. Vishnu Mahádev Tilak to be Extra Assistant Conservator of Forests, Third Grade, vice Mr. Sheshu Manju, retired.

Mr. Chunilál Gulábchand Dalia, L. C. E,, to be Extra Assistant Conservator of Forests, Third Grade, vice Mr. Bhagwandas Harkisandas Dalál, L. C. E., whose lien on his appointment in British service is suspended.

Mr. Abdul Rasul Khájbaksh to be Extra Assistant Conservator of Forests, Fourth Grade *vice* Mr. Vishnu Mahádev Tilak, promoted.

Mr. Harihar Anant Nádkarni, L . C. E , to be Extra Assistant Conservator of Forests Fouth Grade, *vice* Mr. Bhagwandas Harkisandas Dalal.

Mr. Vaman Gopal Turane to be transferred to the Southern and Mr. Abdul Rasul Khajbaksh posted to the Central Circle and Mr. Nádkani to the Southern Circle.

4.—BENGAL GAZETTE.

5th July 1897.—No. 1900For.—The following transfers are ordered :—

Mr. E. P. Stebbing, Assistant Conservator of Forests, attached to the Singhbhum Forests Division, is posted to the charge of the Tista Forest Division.

Mr. F. Trafford, Officiating Deputy Conservator of Forests, in charge of the Tista Forest Division, is, on being relieved by Mr. Stebbing, attached to the Darjeeling Forest Division.

Mr. T. H. Monteath, Assistant Conservator of Forests attached to the Darjeeling Forest Division, is transferred to the Sundarbuns Forest Division and attached to that division.

6th July 1897.—No. 1901For.—Mr. C. G Rogers, I. F. O. H, Deputy Conservator of Forests, 4th grade, on deputation as Instructor at the Imperial Forest School, Dehra Dun, having reverted to his substantive appointment on the Bengal list of Forest Officers in accordance with Notification No. 226-71·3F., dated 26th February, 1897, of the Government of India in the Revenue and Agricultural Department (Forests) with effect from 5th February, 1897, the date on which he availed himself of the two years furlough granted him in that Government Notification No. 150-71-2F., of the 5th idem, the following reversions and temporary promotions are ordered from that date :—

Mr. W. H. Lovegrove, Deputy Conservator of Forests, 4th grade (Provisional). temporary, transferred to the North-Western Provinces, to revert to his substantive appointment of Assistant Conservator of Forests, 1st grade.

Mr. W. F. Lloyd, Deputy Conservator of Forests, 4th grade (sub *pro tem*), to revert to his appointment of Assistant Conservator of Forests, 1st grade, but to continue to officiate in the 4th grade of Deputy Conservators of Forests.

Mr. F. Trafford, Assistant Conservator of Forests, 1st grade (Provisional), and Officiating Deputy Conservator of Forests, 4th grade, sub. *pro tem.*, but to continue to officiate in the 4th grade of Deputy Conservators of Forests.

M. E. P. Stebbing, Assistant Conservator of Forests, 1st grade (sub. *pro tem.*), to revert to his appointment as Assistant Conservator of Forests, 2nd grade, but to continue to officiate in the 1st grade of Assistant Conservator of Forests.

12*th July* 1897.—No. 2029For.—Mr. A. H. Mee, Extra Assistant Conservator of Forests, attached to the Singhbhum Division, is posted to the charge of the Chittagong Division

13*th July* 1897.—No. 2062For.—Mr. C. C Hatt, Officiating Deputy Conservator of Forests, 4th grade, having availed himeslf of the 42 days' privilege leave granted him in Notification No. 671 T, R., dated 28th June, 1897, with effect from the 14th June, 1897, the following temporary promotions are made :—

Mr. E. P. Stebbing, Assistant Conservator, 1st grade, substantive *pro tempore* to officiate in the 4th grade of Deputy Conservators.

Mr. H. A. Farrington, Assistant Conservator, 2nd grade, to officiate in the 1st grade of Assistant Conservators of Forests.

5.—N.-W. P. AND OUDH GAZETTE.

24*th July* 1897.—No. 1963.—II 665B.—With effect from the 21st April, 1897, the date on which Sirdar Hira Singh, Extra Assistant Conservator of Forests, 2nd grade retired from the service.

Lala Har Swarup, Extra Assistant Conservator, from the 3rd to the 2nd grade.

Mr. E. L. Haslett, Extra Assistant Conservators, 3rd grade, sub. *pro tem.*, to be confirmed in that grade;

Pandit Sadanand Gairola, Extra Assistant Conservator, 4th grade to be Extra Assistant Conservator, 3rd grade, sub. *pro tem*,

Lala Parmeshwari Din, Extra Assistant Conservator, 4th grade, sub. *pro tem*, to be confirmed in that grade.

Pandit Rama Dat, Forest Ranger, 2nd grade, to be Extra Assistant Conservator, 4th grade, sub, *pro tem.*, and to be attached to the Jaunsar Division of the School Forest Circle.

6.—PUNJAB GAZETTE.

5*th July* 1897.—*Erratum.*—In Punjab Government Notification No. $\frac{285}{\text{A. L. No. 16}}$ dated 5th June, 1897, *for* "15th March" in column 4 opposite Mr. Linnell's name *read* "25th March."

8th July 1897.—No. $\frac{356}{\text{A. L No. 17.}}$—The following changes have taken place in the list of Forest Officers on the Associated Provinces with effect from the dates specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from.	Remarks.
Mr. A. V. Monro ..	Officiating Deputy Conservator, 3rd Grade.	Deputy Conservator, 4th Grade.	22nd June 1897.	Consequent on the return of Mr. Hart from privilege leave on forenoon of 22nd June, 1897.
Mr. B. O. Coventry	Officiating Deputy Conservator, 4th Grade.	Assistant Conservator, 1st Grade.	22nd June 1897.	

13th July 1897.—No. $\frac{366}{\text{A. L. No 18.}}$—Messrs. G. G. Minniken, Deputy Conservator of Forests, and W. Mayes, Assistant Conservator of Forests, respectively made over and received charge of the Bashahr Forest Division on the afternoon of the 19th June, 1897 consequent on the former's transfer to officiate as Conservator of Forests, Punjab.

Mr. Mayes will hold charge of the Bashahr Division in addition to that of the Simla Division.

13th July 1897.—No $\frac{370}{\text{A. L. No 19.}}$—On return from the privilege leave granted, *vide* Punjab Government Notification No, $\frac{201}{\text{A. L. No. 13}}$ dated 12th April, 1897, Mr. G. S Hart, Deputy Conservator of Forests, took over charge of the Bashahr Forest Division on the forenoon of the 22nd June, 1897, relieving Mr. W. Mayes, Assistant Conservator of Forests, who remains in charge of ths Simla Forest Division.,

26th July 1897.—No. 394.—Mr. G. S. Hart, Deputy Conservator of Forests, is appointed Political Assistant to the Superintendent of Hill States, Simla, during the absence of Mr. G. G. Minniken, Deputy Conservator of Forests, officiating as Conservator of Forests, Punjab, or until further orders, with effect from the 22nd June, 1897.

7.—CENTRAL PROVINCES GAZETTE.

20th July 1897.—No. 3452.—Privilege leave for two months, under Article 291 of the Civil Service Regulations is granted to Mr. F. O. Lemarchand, Deputy Conservator of Forests, Chanda, with effect from the 7th August, 1897, or the subsequent date on which he may avail himself of it.

20th July 1897.—No. 3453.—Mr. A. St. V. Beechey, Assistant Conservator of Forests. in charge of the Pranhita-Godavery Sub-Division, is placed in charge of the Chanda Forest Division, in addition to his own duties, during the absence on leave of Mr. F. O. Lemarchand, Deputy Conservator of Forests, or until further orders.

20*th July* 1897.—No. 6.—Extraordinary leave without allowance for sixteen days, from the 14th to the 29th June 1897, is granted to Forest Ranger Muhammad Yasin, of the Mandla Forest Division, under Article 372 of the Civil Service Regulations.

8.—Burma Gazette.

1*st July* 1897.—No. 223.—Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, 3rd grade, is appointed to be Extra Assistant Conservator, 2nd grade.

7*th July* 1879—No. 15—With reference to Revenue Department Notification No. 186 (Forests), dated the 22nd May, 1897. Mr. C. W. Doveton, Assistant Conservator of Forests, relinquished charge of his duties in the Yamethin subdivision of the Pyinmana division on the afternoon of the 25th ultimo, and took charge of the Kyaukse subdivision, Mandalay division, from Mr. J. Copeland, Deputy Conservator of Forest on the forenoon of the 3rd instant.

9*th July* 1897 --No. 131—At the departmental examination held at Rangoon on the 7th and 8th June, 1897, the following officers passed the examination in Burmese by the standards specified below.

Lower Standard.

Mr. J. W. Ryan, Extra Assistant Conservator of Forests.

9*th July* 1879 —No 238—Under the provisions of Articles 282 (*a*) (*i*) and 291 of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. F. J. Branthwaite, Deputy Conservator of Forests, with effect from the 28th July, 1897, or the subsequent date on which he may avail himself of it.

9*th July* 1897.—239—Mr G. Q. Corbett, Deputy Conservator of Forests, Tharrawaddy, is appointed to the charge of the Prome Forest division, in addition to his other duties, during the absence on leave of Mr. F. J. Branthwaite or until further orders.

15*th July* 1897 —No —With reference to Revenue Department Notification No. 208, dated the 16th June, 1897, Mr. J. W. Ryan, Extra Assistant Conservator of Forests was relieved of his duties in the Toungoo division, on the afternoon of the 23rd June, 1897, and assumed charge of his duties in the Kado subdivision, Kado division, on the afternoon of the 28th June, 1897.

15*th July* 1897.—Under the provisions of Article 340 (*b*) of the Civil Service Regulations, furlough for one year and six months is granted to Mr. E. A. O'Bryen, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

15*th July* 1807—No 246 —Mr. A. E. Ross, Assistant Conservator of Forests, is transferred from the Southern Shan States Division and is appointed to the charge of the Katha Forest Division, as a temporary measure, during the absence on furlough of E. A. O'Bryen or until further orders.

17*th July* 1897—No. 16—With reference to Revenue Department Notification No. 186 (Forests) dated the 22nd May, 1897, Mr. W. H. Craddock, Extra Assistant Conservator of Forests, relinquished charge of his duties in the Mandalay division on the 30th ultimo, af[illegible]oon, and assumed charge of this duties in the Pyinmana division o[illegible] the 1st, instant, afternoon.

19*th July* 1897.—Mr C. M Hodson, Deputy Conservator of Forests has been permitted by Her Majesty's Secretary of State for India t[illegible] eturn to duty within the period of his leave.

22*nd July* 1897.—No. 252.—In exercise of the power conferr[illegible] section 3 of the Burma Forest Act, 1881, and section 2 of the U[illegible] Burma Forest Regulation, 1887, respectively, the Lieutenant-Gover[illegible] appoints the following Extra Assistant Conservators of Forests [illegible] discharge the functions of a Forest Officer, and to exercise all the powers conferred on Sub-Assistant Conservators by the rules hitherto made under the enactments in question:—

Maung Yaing | W. H. Craddock.
R. L. Pocock. | C. E Allen

26*h July* 1897.—No. 23.—With reference to Revenue Department Notification No. 216 (Forests), dated the 24th June, 1897, Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, made over, and Mr. E. M. Buchanan, Extra Deputy Conservator of Forests, received, charge of the Myittha division on the afternoon of the 17th July, 1897

26*th July* 1897 —No. 256 —Mr T. W. Foster, Forest Ranger, is promoted to be a supernumerary Extra Assistant Conservator of Forests, 4th grade, and is transferred from Mogaung to the charge of the Yamethin subdivision, of the Pyinmana forests division.

29*th July* 1897.—No. 257.—Under the provisions of 291 of the Civil Service Regulations privilege leave for three months is granted to Mr. R· L Pocock, Extra Assistant Conservator of Forests, with effect from the 1st August, 1897, or the subsequent date on which he may avail himself of it.

29*th July*. 1897.—No. 258.—On return from leave Mr. C. M. Hodgson, Deputy Conservator of Forests, is appointed to the charge of the Ataran Forest division, Tenasserim Circle.

9.—Assam Gazette.

22*th July* 1897 —No 4731 G—Furlough for one year, under article 371 of the Civil Service Regulations, is granted to Babu Jogesvar Sur, Extra Assistant Conservator of Forests, attached to the Lakhimpur Forest Division, with effect from the 2nd July, 1897, or the subsequent date on which he may have avail himself of it.

29*th July* 1897.—No 31.—The services of Mr. J. C. Carroll, Assistant Conservator of Forests, which were placed temporarily at the disposal of the Public Works Department, in General Department Notification No 4893G. dated the 3rd July, are replaced at the disposal of that Department, with effect from the afternoon of 14th July, 1897.

10.—Hyderabad Residency Gazette.

22*nd June* 1897.—No. 2432-I A.—His Excellency the Viceroy and Governor-General is pleased to confer the title of Khan Bahadur as a personal distinction upon :—

* * * * * *

Ahmad Ali, retired Extra Assistant Conservator of Forests, Berar.

28th *July* 1897.—No. 205.—Mr. W. G. J. Peake, Extra Assistant Conservator of Forests, attached to the Ellichpur Forest Division, has been appointed to the charge of the Buldana Forest Division.

28th *July* 1897.—No. 206.—The following transfers among Divisional Forest Officers are ordered by the Resident:—

Mr. B. Bhukan, from the Buldana to the Amraoti Forest Division,

Mr. Strinivasulu Naidu, from Amraoti to the Wun Division.

28th *July* 1897—No. 207.—Mr. Mansukh Rai, Extra Assistant Conservator of Forests and Divisional Forest Officer, Wun, has been granted privilege leave for 2 months and 27 days, with effect from the 2nd July, 1827.

11.—MYSORE GAZETTE.

6th *July* 1897.—No 109.—Ft. F. 64 95.—Mr. M. Venkatanaranappa, Assistant Conservator of Forests, Tumkur district, having availed himself of eleven days only out of the fifteen days' casual leave granted to him in Government Notification No. 10877.—Ft. F. 64·95, dated the 15th June, 1897, the unexpired portion of the leave, *viz* four days, is hereby cancelled.

10th *July* 4897.—No. 359-Ft F. 1-96.—Under Article 171 of the Mysore Service Regulations, Mr P.E. Benson, Sub-Assistant Conservator of Forests, Shimoga district, was granted casual leave of absence for two days, with effect from the 4th June, 1897.

16th *July* 1897.—No. 660.—Ft. F. 91-95 —Under Article 173 of the Mysore Service Regulations, Mr. B. Srinivasa Rao, Assistant Conservator of Forests, Mysore district, was granted casual leave of absence for fifteen days, with effect from the 23rd June, 1897.

16th *July* 1867.—No. 66.—Ft. F. 89-95.—The fourteen days' casual leave of absence granted to Mr. K. Shamaiengar, Sub-Assistant Conservator of Forests, Chitaldrug district, in Government Notification No. 10880.—Ft. F. 89-95, dated 15th ultimo, is hereby extended by one day.

22nd *July* 1897.—No. 916.—Ft. F. 1-95.—Mr. A. G. R Theobald, Sub-Assistant Conservator of Forests, Mysore district, having availed himself of the two months' privilege leave granted to him in Government Notification No. 10874—Ft. F. 1-95, dated 15th June, 1897, from the 8th April, 1897, and returned to duty on the forenoon of the 2nd June, 1897, the unexpired portion of the leave, *viz.*, six days, is hereby cancelled.

28th *July* 1897.—No. 1239.—Ft. F. 92-95.—Under article 172 of the Mysore Service Regulations, Mr. Y. Sitaramaiya, Assistant Conservator of Forests, Kadur district, on special duty, is granted casual leave of absence for fifteen days, with effect from the 20th July, 1897, or from such other date as he may avail himself of the same.

VIII--EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

12th August, 1897.—No. 780—202-4-F.—The following promotions are ordered in consequence of the retirement from the service of Mr. P. J. Carter, Conservator of Forests, 2nd grade, with effect from the 27th July 1897 :

(i) Lieutenant-Colonel C. T. Bingham, I. S. C., Conservator, 3rd grade, and officiating in the 2nd grade, is confirmed in the latter grade.

(ii) Mr. A. Smythies, officiating Conservator, 3rd grade, is confirmed in that grade, and will officiate in the 2nd grade, until further orders.

20th August, 1897.—No. 808—217-4-F.—Privilege leave for one month and twelve days, under Articles 291 and 282 (ii) of the Civil Service Regulations, is granted to Mr. G. F. Prevost, officiating Conservator in charge of the Pegu Forest Circle, Lower Burma, with effect from the afternoon of the 12th August 1897.

Lieutenant-Colonel C. T. Bingham, I. S. C., Conservator in charge of the Tenasserim Circle, is placed in charge of the Pegu Circle, in addition to his other duties, during Mr. Prevost's absence, or until further orders.

2—MADRAS GAZETTE.

31st July 1897.—*Departmental Test.*—The following subordinate passed the Departmental Test in Forest Act and Rules at an examination held on the 26th July 1897 :—

H. W. Gandoin, Forester, North Arcot.

1st August 1897.—*Extension of leave.*—The two months' privilege leave granted to G. W. Thompson, Forest Ranger, North Arcot district, and notified at page 809, Part II of the *Fort St. George Gazette* dated 13th July 1897, is extended by thirteen days.

9th August 1897.—*Appointment confirmed.*—M S. Noronha, sub. *pro tem*, Ranger, 4th Grade, on Rs. 80, confirmed in his appointment from 1st January 1897.

10th August 1897.—*No.* 385.—Mr. J. W. Cherry, Conservator of Forests, Madras, has been granted by the Right Honourable the Secretary of State for India an extension of three months' leave on medical certificate in continuation of the leave notified (in notification No. 32) at page 104 of Part I of the *Fort St. George Gazette* dated 19th January 1897.

19th August, 1897,—*Leave.* —Ranger H. O'Neill, South Coimbatore division, granted privilege leave for three months from 4th July 1897.

21st August 1897.—*No.* 395.—Mr. E. D. M. Hooper, Acting Conservator of Forests, Southern Circle, is granted leave on urgent private affairs for six months, with effect from or after the 14th September 1897; under article 348 of the Civil Service Regulations.

3.—BOMBAY GAZETTE.

5th August 1897.—No. 2951.—Mr. Haripad Mitra, Extra Assistant Conservator of Forests, Working Plans Party 1, Southern Circle, who was transferred to Sind Circle in Government Resolution No. 3696, dated 15th May 1897, handed over charge of his office to Mr. W. E, Copleston, Divisional Forest Officer, Working Plans, Southern Circle, in the afternoon of 2nd August 1897.

7th August 1897.—No. 3021 —Mr. Harihar Anant Nadkarni, L C.E. who was appointed Extra Assistant Conservator of Forests, Fourth Grade, in Government Resolution No. 5699, dated 29th July 1897, reported himself for duty as such to the undersigned on the forenoon of 3rd August 1897, and received charge of the Extra Assistant's Office, Working Plans Party I., S. C., on the same day.

9th August 1897.—No. 5875.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr. Ardeshir Nasarvanji Master, L. C. E., to be Extra Assistant Conservator of Forests, Central Circle.

Mr. Vishnu Mahadev Tilak to be Extra Assistant Conservator of Forests, Northern Circle.

13th August 1897.—No. 6028.—His Excellency the Governor in Council is pleased to appoint Mr. Ganesh Sakharam Hinge to hold charge of the office of Divisional Forest Officer, Nasik, from the date of Mr. G. R, Duxbury's leave or pending further orders.

13th August 1897.—No. 6035.—Mr. G. R. Duxbury, Assistant Conservator of Forests, First Grade, and Divisional Forest Officer, Nasik, is allowed privilege leave of absence for three months from 19th August 1897, or such subsequent date as he may avail himself of it.

21st August 1897.—No. 3329.—Mr. Waman Gopal Tumne, Extra Assistant Conservator, who was transferred to the Southern Circle in Government Resolution No. 5699, dated 29th July 1897, received charge of the Sub-Divisional Officer, Kolaba, from Mr. A. C, Robinson, Divisional Forest Officer, Kolaba, on the forenoon of the 16th August 1897.

23rd August 1897.—No. 2984.—Messrs. Vaman Gopal Tnmne and Abdul Rasul Khajbax, Extra Assistant Conservators of Forests, respectively delivered over and received charge of the Sub-Division Office, West Khandesh, on the 11th instant, afternoon.

24th August 1897.—No, 3022.—Messrs. G. R. Duxbury, Assistant Conservator of Forests, and G. S. Hinge, Extra Assistant Conservator of Forests, respectively delivered over and received charge of the Divisional Forest Office, Nasik, on the 19th August 1897, after noon.

4.—BENGAL GAZETTE.

9th August 1897.—No. 2406.—Twenty days' privilege leave under Article 291 of the Civil Service Regulations is granted to Mr. A. H. Mee, Extra Assistant Conservator of Forests, in charge of the Chittagong Division, with effect from the afternoon of the 28th June 1897,

Mr. J. Donald, Assistant Magistrate, Chittagong, held charge of the Chittagong Division, from the 29th June to the 18th July 1897, both days inclusive, as a temporary measure, during the absence of Mr. Mee on leave.

9th August, 1897.—No. 2408.—Consequent on the return to duty, on the forenoon of the 25th July 1897, of Mr. C. C. Hatt Officiating Deputy Conservator of Forests, 4th grade, from the 42 days' privilege leave granted him in Notification No. 671T. R., dated the 28th June 1897, the following reversions are ordered with effect from the above date :—

Mr. E. P. Stebbing, Officiating Deputy Conservator of Forests, 4th grade, to Officiating Assistant Conservator of Forests, 1st grade.

Mr. H. A. Farrington, Officiating Assistant Conservator of Forests 1st grade, to Assistant Conservator of Forests, 2nd grade.

24th August 1897.—No. 2576.—Three months' privilege leave, under article 291 of the Civil Service Regulations, is granted to Mr. E. P. Stebbing, Assistant Conservator of Forests, in charge of the Tista Division, with effect from the 4th September 1897, or from such subsequent date as he may avail himself of it

Mr. F. Trafford, Officiating Deputy Conservator of Forests, attached to the Darjeeling Division, is transferred to the charge of the Tista Division, during the absence, on leave, of Mr. Stebbing, or until further orders.

9th August 1897.—No. 2409.—In Notification No. 2062 Forests, dated the 13th July 1897, published at page 966, part I of the *Calcutta Gazette* of the 14th idem, *for* Mr. E. P. Stebbing, Assistant Conservator, 1st grade, substantive *pro tempore, read* Mr. E. P. Stebbfng, Officiating Assistant Conservator of Forests, 1st grade.

5.—N.-W. P. AND OUDH GAZETTE.

3rd August 1896.—N. $\frac{2056}{\text{II.-181c}}$. Lala Parmeshwari Din, Extra Assistant Conservator of Forests, attached to the Kheri Division of the Oudh Forest Circle, privilege leave for one month and fifteen days with effect from the 16th August. 1897.

4th August 1897.—No. $\frac{2083}{\text{II. 429C}}$, Babu Raghu Nath Pathak, Extra Assistant Conservator of Forests, Kheri Division. Oudh Forest circle privilege leave for one month and fifteen days with effect from the 1st August, 1897.

4th August 1897.—No. $\frac{2090}{\text{II. 622B.}}$ The undermentioned officer has been granted by Her Majesty's Secretary of State for India extension of leave :—

NAME.	Service.	Appointment.	Period and nature of leave.
Mr. A. P. Grenfell.	**Forests.**	**Deputy Conservator of Forest.**	**Six months on medical certificate.**

10*th August* 1897.—No. $\frac{2109}{\text{II-860.}}$ Babu Nand Mal, Extra Assistant Conservator of Forests, Bahraich Divison of the Oudh Forest Circle, privilege leave for six weeks with effect from the 13th August, 1897.

10*th Augast* 1897.—No. $\frac{2134}{\text{I-622B.}}$ The undermentioned officer has been granted by Her Majesty's Secretary of State for India permission to return to duty :—

NAME.	Service.	Appointment.	Date on which permitted to return.
Mr. B. A. Rebsch.	Forest.	Deputy Conservator of Forests.	Within period of leave.

18*th August* 1897.—No. $\frac{2188}{\text{II-622B.}}$ The undermentioned officer has been granted by the Majesty's Secretary of State for India extension of leave.

NAME.	Service.	Appointment.	Period and nature of leave.
Mr. B. A. Rebsch.	Forest.	Deputy Conservator of Forests	Six days furlough.

6.—PUNJAB GAZETTE.

2*nd August*, 1897.—No. $\frac{401}{\text{A. L. No. 20.}}$— *Examination.*—Mr. W. Mayes, Assistant Conservator of Forests, 2nd Grade, passed the prescribed departmental examination in Procedure and Accounts held at Simla on the 14th July 1897.

21*st August*, 1897 —No. 421.—*Leave.*—Mr. E. M. Coventry, Officiating Deputy Conservator of Forests, 4th Grade, has been granted three months' privilege leave, under Articles 277 and 291 of the Civil Service Regulations, with effect from the 1st July 1897, the date from which his services were replaced at the disposal of the Government of the Punjab,—*vide* Government of India Notification No. $\frac{527}{107-9}$ F. dated 9th June 1897.

7.—CENTRAL PROVINCES GAZETTE.

7*th August*, 1897.—No. 9.—Privilege leave for one month, under Article 291 of the Civil Service Regulations, is granted to Mr. A. T. C. Howell, Ranger, 2nd grade, of the Nimar Forest Division, with effect from such date as he may be permitted to avail himself of it.

16*th August*, 1897.—No. 10.—Mr A. T. C. Howell, Ranger, Nimar, availed himself, on the afternoon of the 8th instant, of the leave granted him by Order No. 9, dated the 7th idem.

19*th August*, 1897.—No. 3813.—Mr. W. P. Thomas, Deputy Conservator of Forests, Hoshangabad Forest Division, is transferred temporarily to the Direction Division for employment on special duty under the Conservator of Forests, Northern Circle, Central Provinces.

19th August, 1897.—3814.—Mr. H. E. Bartlett, Assistant Conservator of Forests, attached to the Nimar Forest Division, is posted to the charge of the Hoshangabad Forest Division during the absence of Mr. W. P. Thomas on deputation, or until further orders.

19th August, 1897.—No. 3821.—With reference to Order No. 3814, dated the 19th instant, Mr. H. E. Bartlett, Assistant Conservator of Forests, made over charge of his duties in the Nimar Forest Division on the forenoon of the 2nd idem.

19th August, 1897.—No. 3822.—With reference to Order No. 3813, dated the 19th instant, Mr. W. P. Thomas, Deputy Conservator of Forests, and Mr. H. E. Bartlett, Assistant Conservator of Forests, respectively made over and assumed charge of the Hoshangabad Forest Division on the afternoon of the 7th idem.

21st August, 1897.—No. 11.—Privilege leave for fifteen days is granted, under Article 291 of the Civil Service Regulations, to Mr. R. H. Cole, Ranger, 5th grade, Mandla Division, with effect from the 26th August 1897 or the subsequent date on which he may be permitted to avail himself of it.

24th August, 1897.—No. 3879.—Mr. F. O. Lemarchand, Deputy Conservator of Forests, Chanda, availed himself, on the afternoon of the 9th instant, of the two months' privilege leave granted him by Order No. 3452, dated the 20th ultimo, making over charge of his duties to Mr. A. St. V. Beechey, Assistant Conservator of Forests.

8.—BURMA GAZETTE.

30th July, 1897.—No. 260,—Under the provisions of Article 291 of the Civil Service Regulations privilege leave for one mouth and 28 days is granted to Mr. J. W. Ryan, Extra Assistant Conservator of Forests, with effect from the 1st August 1897 or the subsequent date on which he may avail himself of it.

30th July, 1897.—No. 16.—With reference to Revenue Department Notifications Nos. 238 and 239, dated the 9th July 1897, Mr F. J. Branthwaite, Deputy Conservator of Forests, and Mr. G. Q. Corbett, Deputy Conservator of Forests, respectively made over and received charge of the Prome Forest Division on the afternoon of the 29th July 1897.

30th July, 1897.—No. 10.—Mr. W. Dalton, Forest Ranger, 3rd grade, is transferred temporarily from the Thaungyin to the Kado Division with effect from the 10th July 1897.

3rd August, 1897.—No. 151,—At the departmental examination held at Bassein, Akyab, Moulmein, Mergui, Minbu, Myingyan, Meiktila. Mandalay, Mogôk, Mônywa, Kindat, Taunggyi, Falam and Shwebo on the 7th June 1897, at Bhamo on the 14th June 1897, and at Lashio on the 16th June 1897, the following officers passed the examination in Burmese by the standards specified below :—

Higher Standard.

Mr. W. H. Craddock, Extra Assistant Conservator of Forests.

Mr. B. P. Kelly. Forest Ranger.

Lower Standard.

Mr. C. W. Doveton, Assistant Conservator of Forests,—*with great credit*

Mr. R. P. Kelly, Forest Ronger,— *with credit.*

3rd August, 1897.—No. 154,—At the departmental examination held at Rangoon, Bassein, Moulmein, Myingyan, Meiktila, Mandalay, Kindat and Taunggyi, on the 7th June 1897, the following Forest Officers passed in the subjects specified below according to the standards prescribed for the examination of Forest Officers :—

Law·

Mr. G. K, Parker, Assistant Conservator of Forests.
Mr. C. E. Allan, Extra Assistant Conservator of Forests.
Mr. J. L. Hefferman, Forest Ranger.
Mr. R. R O'Hara, Forest Ranger.
Mr. P. E, Plunkett, Forest Ranger.
Mr. W. J. Dalton, Forest Ranger.
Mr. B. P. Kelly, Forest Ranger.
Mr. S. E. F, Jenkins, Forest Ranger.

Revenue.

Mr. R. R. O'Hara, Forest Ranger.
Mr. B. P. Kelly, Forest Ranger.
Mr. S. E. F. Jenkins, Forest Ranger.

Procedure and Accounts.

Mr. A. E. Ross, Assistant Conservator of Forests.
Mr. G. E. S. Cubitt, Assistant Conservator of Forests.
Mr. G. K. Parker, Assistant Conservator of Forests.
Mr. C. E. Allen, Extra Assistant Conservator of Forests.
Mr. R. C. A. Pinder, Forest Ranger.
Mr R. R. O'Hara, Forest Ranger.
Mr W. J. Dalton, Forest Ranger.

7th August 1897.—No. 17.—With reference to Revenue Department Notification No. 257 (Forests), dated the 29th July 1897, Mr. R L. Pocock, Supernumerary Extra Assistant Conservator of Forests, relinquished charge of his duties in the Katha Forest Division on the 1st August 1897, before noon, and proceeded on three months' privilege leave from the same date.

9th August 1897.—No. 11.—Mr. J. W. Ryan, Extra Assistant Conservator of Forests. availed himself of the one month and 28 days' leave granted him on the afternoon of the 4th August 1897

9th August 1897.—No. 266 —Mr. G. F. R. Blackwell, Deputy Conservator of Forests. has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

9th August 1897.—No. 267.—Under the provision of Article 291 of the Civil Service Regulations privilege leave for three months is granted to Mr. C. Ingram, Extra Deputy Conservator of Forests, with effect from the 20th August 1897, or the subsequent date on which he avail may himself of it.

9th August 1897.—No. 268.—Mr. H. Calthrop, Deputy Conservator of Forests, on return from leave is posted to the charge of the Shwegyin division.

11th August 1897.—No. 24.—Mr. G. T. Wrafter, Ranger, 2nd grade, on transfer to the Magwe division, made over charge of his duties in the Lower Chindwin division on the forenoon of the 9th July 1897 and assumed charge of his duties in the Magwe division on the forenoon of the 28th July 1897.

12th *August* 1897.—No 272—Mr W. J. Lane-Ryan, Extra Assistant Conservotor of Forests, 2nd Grade his appointed to be Extra Assistant Conservator 1st grade

14th *August* 897 — No. 19.—Mr. A E. Ross, Assistant Conservator of Forests, reported his arrival at Katha and was attached to that division from the forenoon of the 26th July 1897

14th *August* 1897—No. 20—With reference to Revenue Department Notification No 246 (Forests), dated the 1 th July 1897, Mr E. A O'Bryen, Deputy Conservator of Forests made over, and Mr A E Ross, Assistant Conservator of Forests, received, charge of the Katha Forest division on the forenoon of the 11th August 1897.

14th *August* 1897 —No 21 —Mr E A O Bryen, Deputy Conservator of Forests, availed himself on the forenoon of the 11th instant of subsidiary leave preparatory to furlough granted to him in Notification No 245, (Forests), dated the 15th July 1897

16th *August* 1897 —No. 276 —Under the provisions of Article 340 (*b*) of the Civil Service Regulations furlough for three days is granted to Mr C E Muriel, Deputy Conservator of Forests, in continuation of the furlough granted in this department Notification No 335 dated the 13th November 1895.

19th *August* 1897 —No 285 —Under the provisions of Article 340 (*b*) of the Civil Service Regulations and in supersession of this department Notfication No. 245, dated the 15th July 1897, furlough for one year and three months is granted to Mr E A O'Bryen, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

20th *August*, 1897 —No 289 —Under the provisions of Article 291 of the Civil Service Regulations privilege leave for three months is granted to Mr F. Ryan, Extra Assistant Conservator of Forests, with effect from the 6th September 1897, or the subsequent date on which he may avail himself of it

24th *August*, 1897.—No. 12.—Mr J. N Thurston, Deputy Commissioner, made over and Mr J. G F Marshall, Extra Deputy Conservator of Forests, received, charge of the South Tenasserim division on the forenoon of the 29th June 1897

25th *August*, 1897.—No 18 —Under Article 291 of the Civil Service Regulations privilege leave for three months was granted to Maung Pe, Forest Ranger, 2nd grade, which he availed himself of with effect from the 19th July 1897.

26th *August*, 1897.—No. 13.—With reference to Notification No. 268 (Forests), dated the 9th August 1897, Mr. C. Ingram, Extra Deputy Conservator of Forests, made over and Mr. H. Calthrop, Deputy Couservator of Forests, received, charge of the Shwegyin division on the forenoon of the 22nd August 1897.

28th *August*, 1897 —No. 22.—Mr. T. W. Forster, Supernumerary Extra Assistant Conservator of Forests, made over charge of the Mogaung range of the Katha division to Mr W R French, Ranger, on the afternoon of the 11th August 1897, and assumed charge of the Yamethin subdivision of the Pyinmana division on the forenoon of the 19th August 1897

9 ASSAM GAZETTE

6th August 1897.—No 5104 G.—Mr. J. C. Carroll, Assistant Conservator of Forests, whose services have been replaced at the disposal of this Department by Public Works Department Notification No. 31, dated the 19th July 1897, returned to special duty in the office of the Conservator of Forests, Assam, on the afternoon of the 14th July 1897.

13th August 1897—No. 5350 G.—Furlough on medical certificate for three months, under article 340 (*a*) of the Civil Service Regulations, is granted to Mr. A. M. Long Assistant Conservator of Forests, in extension of the leave granted in Notificanton No. 1420 G., dated the 26th Fobruary 1897.

13th August 1897—No 5357 G.—Mr. A, R. Dicks. Assistant Conservator of Forests, Second Grade, is appointed to officiate as Assistant Conservator of Forests, First Grade, with effect from the 10th May 1897.

10 HYDERABAD RESIDENCY GAZETTE.

Nil

11 MYSORE GAZETTE.

Nil

VIII--EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

8th September, 1897.—No. 871—221-4-F.—Mr. J. A. McKee, Conservator of Forests, 3rd (officiating 2nd) grade, in charge of the Southern Forest Circle, Central Provinces, is granted privilege leave for two months and twenty-eight days, under Articles 277 and 291 of the Civil Service Regulations, with effect from the afternoon of the 1st instant.

Mr. W. P. Thomas, Deputy Conservator, 1st grade, Central Provinces, appointed to officiate as Conservator, 3rd grade, and to be in charge of the Southern Forest Circle, during Mr. McKee's absence, or until further orders.

24th September, 1897.—No. 911—117-6-F —On return from the privilege leave granted him in Notification No. 808-F., dated the 20th ultimo, Mr. G. F. Prevost Officiating Conservator, 3rd grade, resumed charge of the Pegu Forest Circle, Lower Burma, from Lieutenant-Colonel C. T. Bingham, I.S.C., Conservator in charge of the Tenasserim Forest Circle, with effect from the forenoon of the 20th instant.

30th September, 1897.—No. 922—156-6-F.—On the return of Mr. C. F. Elliot, Conservator, 3rd (officiating 2nd) grade, in charge of the Punjab Forest Circle, from the privilege leave granted him in Notification No. 634-F., dated the 2nd July last, Mr. G. G. Minniken, officiating Conservator, 3rd grade, reverted to his substantive appointment of Deputy Conservator 1st grade, with effect from the afternoon of the 22nd instant.

2—MADRAS GAZETTE.

25th August, 1897 —To N. Balaji Singh, Ranger, 5th grade, Nellore district, for three months, under article 369 of the Civil Service Regulations, in continuation of the leave already granted to him.

31st August, 1897.—*Resignation*—Mr. W. H. Blacker, Ranger, South Arcot District, is permitted to resign his appointment from date of relief.

7th September, 1897.—*Promotion*.—The following promotions are ordered in the Southern Circle :—

Name.	Present grade.	Grade to which promoted.	Nature of promotion.	With effect from.
C. S. Venkatramaniah ...	Ranger, 6th Grade, North Malabar.	Ranger, 5th Grade.	Sub. *pro tem*	1st April 1897 *vice* J. W. Ryan on other duty.
P. Venkatakrishnama Naidu	Ranger, 6th Grade, South Canara.	Ranger, 5th Grade.	Do.	17th May 1897 *vice* Mr. Monisse.

8th September, 1897.—No. 422.—Mr. F. R. Murray, District Forest Officer Anantapur, is granted privilege leave for one month and ten days, with effect from or after the 1st October 1897 under article 291 of the Civil Service Regulations.

11th September, 1897.—No. 423.—Appointment.

Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
Mr. H. A. Gass.	Deputy Conservator of Forests, 1st Grade.	Conservator of Forests, 3rd Grade.	Acting	During the absence of Mr. Cherry on leave, or until further orders. The appointment is to take effect from the date of Mr. Hooper's departure on special leave.

POSTING.

11th September, No. 424.—

Name of Officer.	District.	Nature of charge.	Remarks.
Mr. H. A. Gass, Acting Conservator Forests 3rd Grade.	Southern Circle.	Acting .	During the absence of Mr. Cherry, on leave, or until further orders

13th September, 1897.—*Departmental Test Examination.*—The following are the results of the Departmental Test Examination held on the 26th July, 1897, under section 69 of the Revised Code :—

Name.	Designation and district in which employed.	Subjects in which passed.
1. K. Subramania Iyer	Acting Forester, Second Grade, North Coimbatore.	(*a*) Accounts and Return and (*b*) Forest Act and Rules.
2. S. Krishnamurthi Iyer	Probationary Forester, First Grade, Madura.	Do.
3. Venkataramana Iyer	Acting Forester, Second Grade Tinnevelly.	(*b*) Forest Act and Rules.
4. S. Sivasubramania Iyer	Acting Forester, Second Grade, South Malabar.	Do.
5. P. Samuel Pillai	Temporary Deputy Ranger, Third Grade, Tinnevelly.	Do,

6. A. P. Srinivasa Iyenger ...	Probationary Third Grade, Tinevelly	(b) Forest Act & Rules.
7. M. Ponnusawmi Pillai	Forester, Second Grade, Madura.	Do.
8. D. Annasawmi Iyer	Acting Forester, Second Grade, Madura.	Do.

14th September, 1897 —No. 436.—Mr. A. W. Lushington, Deputy Conservator of Forests, Kistna, is granted privilege leave for one month and three days, with effect from or after the 15th instant, under article 291 of the Civil Service Regulations

18th September, 1897 —*Transfer.*—Mr. H O'Neill, Ranger, Second Grade, transferred from South Coimbatore to Nilgiris. To join after the expiry of his privilege leave.

POSTING.

22nd September, No. 443.—

No.	Name and designation of Officer.	District.	Nature of charge.	Remarks.
1	M. R. Ry. T. M. Nallaswami Naidu Garu, Extra Assistant Conservator of Forests, Second Grade.	Kistna	Acting District Forest Officer.	During the absence of Mr. A. W. Lushington on privilege leave, or until further orders.

APPOINTMENT.

22nd September, 1897.—No. 444.—

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. H. Tireman ...	Assistant Conservator of Forests, Second Grade, and acting in the First Grade.	Deputy Conservator of Forests, Fourth Grade.	Acting	During the absence of Mr. G. Hadfield on furlough. The acting appointment to last until 30th, December 1896 the date of Mr. Foulkes' deputation to Cochin.

22th September. 1897.—No 442 —Mr. W. Carroll, Extra Assistant Conservator of Forests is granted leave on medical certificate for six months, with effect from 15th July 1897, under article 369 of the Civil Service Regulations.

POSTING.

25th September, 1897.—No, 445.—

No.	Name and designation of Officer.	District.	Nature of charge.	Remarks.
1	Mr. F. C. L. Cowley Brown, Acting Deputy Conservator of Forests, 4th Grade.	South Coimbatore.	Acting District Forest Officer.	During the employment of Mr H. A. Gass as Conservator, or until further orders.

30th September, 1897.—*Promotion.*—N. Swaminatha Iyar, Ranger, 6th Grade, promoted to act as Ranger, 5th Grade, *vice* M. Balaji Sing on leave, with effect from 18th April 1897.

3.—BOMBAY GAZETTE.

11th September, 1897.—No. 6820.—His Excellency the Governor in Council is pleased to confer upon Mr. Haripad Mitra, Extra Assistant Conservator of Forests and Divisional Forest Officer, Hyderabad, the powers mentioned in section 67 of the Indian Forest Act., No. VII of 1878, as amended by Section 13 of Act. No. V of 1890.

13th September, 1897.—No. 6834.—His Excellency the Governor in Council is pleased to confer upon Mr. Ganesh Sakharam Hinge, Extra Assistant Conservator of Forests and Divisional Forest Officer, Nasik, the powers mentioned in Section 67 of the Indian Forest Act, No. VII of 1878, as amended by Section 13 of Act No. V of 1890.

14th September, 1897.—No. 6856.—Mr. H. W. Keys, Deputy Conservator of Forests, Third grade, and Divisional Forest Officer, West Khandesh, is allowed privilege leave of absence for one month and eighteen days.

14th September, 1897.—No. 3934.—Messes. W. W. Drew and K. R. Bamanji respectively delivered over and received charge of the Ratnagiri Forest Division on the forenoon of 8th September 1897.

18th September, 1897,—No. 7001.—His Excellency the Governor in Council is pleased to appoint Mr. Rustamji Hormasji Madan, L. C. E., (Bo.), to hold charge of the office of Divisional Forest Officer, West Khandesh, in addition to his own duties, during the absence on leave of Mr. H. W. Keys or pending further orders.

21st September, 1897.—No. 1791.—Messrs. A. N. Master, L. C. E., Extra Assistant Conservator of Forests. Second grade, aud J. Dodgson, Assistant Conservator of Forests, Second grade, respectively delivered over and received charge of the Central Thana Sub-Division Office on the 13th September 1897, in the afternoon

22nd September, 1897.—No 3923 —Messrs. H. W. Keys, Deputy Conservator of Forests, and R. H Madan, extra Deputy Conservator of Forests, respectively delivered over and received charge of the Divisional Forest Office, West Khandesh, on the 16th September, 1897, afternoon.

28th September 1897.—No. 1890.—Messrs. J. Dodgson, Assistant Conservator of Forests, Second Grade, and V. M. Tilak, Extra Assistant Censervator of Forests, Third Grade, respcetively delivered over and received charge of the Central Thana Sub-division Office on the 28th September 1897, in the forenoon.

28th September, 1897.—No. 1890. Messrs. Dodgson, Assistant Conservator of Forests. Second Grade, and V. M. Tilak Extra Assistant Conservator of Forests, Third Grade, respectively delivered over and received charge of the Central Thana Sub-division Office on the 28th September 1897, in the forenoon.

29th September, 1897.—No. 7171.—Mr. C. Greatheed, Deputy Conservator of Forests, Second Grade, has been allowed by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

30th September, 1897 —No. 3796 —Messrs. W R. Govande and A. N. Master, Extra Assistant Conservators respectively delivered over and received charge of the Sub-Division Forest Office, Satara, on the 22nd September 1897, before noon.

4.—Bengal Gazette.

9th September, 1897.—No. 721 T. R.—Twenty days', privilege leave, under article 291 of the Civil Service Regulations, is granted to Mr. J. W. A. Greive, Assistant Conservator of Forests, attached to the Singhbhum Forest Division, with effect from the 14th September 1897, or from such subsequent date as he may avail himself of it.

5.—N.-W. P. and Oudh Gazette.

7th September, 1897.—No. $\frac{2425.}{\text{II. 310.}}$ The services of Colonel J. E. Campbell, I. S. C., late a Deputy Conservator of Forests, North-Western Provinces and Oudh, are re-placed at the disposal of the Government of India, Military Department, with effect from the 4th September 1897, under the provision of Article 679 of Civil Service Regulations.

15th September, 1897.—No. $\frac{2521}{\text{II 622 B.}}$ The undermentioned Officer has been granted by Her Majesty's Secretary of State for India extension of leave.

Name.	Service.	Appointment.	Period and nature of leave.
Mr. J. S. Gamble	Forest	Conservator of Forests	Two months' furlough.

15th *September*, 1897.—No. $\frac{4521}{\text{II. 429 C.}}$—Babu Raghu Nath Pathr Extra Assistant Conservator of Forests, on return from leave, to be attached to the Direction Division of the Oudh Forest Circle as Working Plans Officer.

6.—PUNJAB GAZETTE.

4th *September*, 1897.—No. $\frac{484}{\text{A L- No. 21.}}$ The following changes have taken place in the List of Forest Officers on the Associated Provinces with effect from the dates specified against each :—

NAME.	Present grade.	Grade to which promoted or reverted.	With effect from	REMARKS.
Mr. C. O. Hanson	Officiating Deputy Conservator, 4th Grade.	Assistant Conservator, 1st Grade.	1st July 1897	Consequent on Mr. E. M Coventry's return from North-Western Provinces to Punjab with effect from 1st July 1897.
Mr. G. G. Minniken. ..	Deputy Conservator, 1st Grade.	Officiating Conservator of Forests.	23rd June '97	Consequent on Mr. Elliott's going on 3 months' privilege leave from 22nd June '97 (afternoon).
Mr. W. King ...	Deputy Conservator 2nd grade.	Officiating Deputy Conservator, 1st Grade.	23rd July '97	Ditto.
Mr. A. T. McIntire ...	Deputy Conservator, 3rd grade	Officiating Deputy Conservator, 2nd Grade.	23rd July '97	Ditto.
Mr. A. V. Monro	Deputy Conservator, 4th grade	Officiating Deputy Conservator, 3rd Grade.	23rd July '97	Ditto.
Mr. C. O. Hansen	Assistant Conservator, 1st Grade. ..	Officiating Deputy Conservator, 4th Grade.	23rd July '97	Ditto.
Mr. B. O Coventry ...	Assistant Conservator, 1st Grade. ..	Officiating Deputy Conservator, 4th Grade.	31st July '97	Consequent on Mr. E. M. Coventry's going on 3 months' privilege leave from 1st July 1897.

17th September 1897.—No.—$\frac{462}{\text{A. L. 22}}$.—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the dates specified against each:—

NAMES.	Present Grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
M. E. A. Down	Deputy Conservator, 2nd grade	Officiating Deputy Conservator, 1st Grade.	9th September 1897.	Consequent on Mr. F. O. Lemarchand going on two months' privilege leave from afternoon of 9th August 1897.
Mr. H A. Hoghton —	Deputy Conservator, 3rd grade.	Officiating Deputy Conservator, 2nd Grade.	Ditto.	
Mr. A. W. Blunt	Deputy Conservator, 4th grade.	Officiating Deputy Conservator. 3rd Grade.	Ditto.	
Mr. A. St. V. Beechey ...	Provisional Assistant Conservator 1st Grade.	Officiating Deputy Conservator, 4th Grade.	Ditto.	

Erratum.—In *Punjab Government Gazette* Notification No. 86, dated the 30th of January 1895, read "4,312" instead of "4,512" acres as the area disforested.

7.—CENTRAL PROVINCES GAZETTE.

1st September, 189.—No 127.—With the sanction of the Chief Commissioner, the resignation tendered by Mr. A. T. C. Howell, Ranger 2nd grade, attached to the Nimar Division, of his appointment in Government service, is accepted with effect from the afternoon of the 26th August 1897, at which time he was relieved of his duties.

2nd September, 1897.—No. 3982.—With reference to Order No. 3813, dated the 19th ultimo, Mr. W. P. Thomas, Deputy Conservator of Forests, assumed charge of his duties at Jubbulpore on the forenoon of the 13th idem.

3rd September, 1897.—No. 4011.—Privilege leave for 17 days, under Article 291 of the Civil Service Regulations, is granted to Mr. Chanda Kumar Chatterji, Extra-Assistant Conservator of Forests, Bhandara Forest Division, with effect from the 21st ultimo.

3rd September, 1897.—No. 13.—Messrs R. H. Cole and Chintaman, Vishwanath, Rangers in the Mandla Division, are transferred as a temporary measure to the Direction Division for the purpose of assisting in the final preparation of the working-plans for the forests of the Mandla Division.

3rd September, 1897.—No. 14.—Mr. R. H. Cole, Ranger, Mandla, availed himself, on the forenoon of the 27th August 1897, of the privilege leave granted him by Departmental Order No. 11, dated the 21st

8th September 1897.—No. 4053.—Privilege leave for three months, under Articles 277 and 291 of the Civil Service Regulations, is granted to Mr. G. F. Taylor, Deputy Conservator of Forests,, Saugor Division, with effect from the 10th instant, or the subsequent date on which be may avail himself of it.

8th September, 1897.—No. 4053.—Mr H. E. Bartlett, Assistant Conservator of Forests and Divisional Forest Officer, Hoshangabad, is placed in charge of the Saugor Division, during the absence of Mr. G. F. Taylor, Deputy Censervator of Forests. or until further orders.

8th September, 1897.—No. 4055.—Mr. M. Muttannah, Deputy Conservator of Forests, in charge of the Nimar Forest Division, is appointed to hold charge of the Hoshangabad Forest Division in addition, during the deputation of Mr. H. E Bartlett, or until further orders.

8th September 1897 —No. 4057.—Consequent on the retirement of Mr. Ahmad Ali, Extra Assistant Conservator of Forests, Berar, the Chief Commissioner is pleased to promote Mr. R. C. Thompson, Extra Assistant Conservator of Forests, 4th grade, to be Extra-Assistant Conservator of Forests, 3rd grade, sub. *pro tem.*, with effect from the 1st April 1896.

(NOTE.—This promotion is subject to the condition that Mr. Thompson passes the Examination in Vernacular by the Higher Standard in October next.

8th September, 1897.—No. 4058.—Consequent on the appointment of Messrs. C. K. Chatterji and Mansukh Rai, Extra.Assistant Conservators of Forests, 2nd grade, to fill appointments Nos 36 and 37 on the Imperial List, the Chief Comissioner is pleased to make the following promotions with effect from the 6th June 1896 :—

Mr. Ramchandra Krishna, Extra-Assistant Conservator of Forests, 3rd grade, to be Extra-Assistant Conservator of Forests, 2nd grade.

Mr. Muhammad Kadir Bakhsh, Extra-Assistant Conservator of Forests, 3rd grade, to be Exrta-Assistant Conservator of Forests, 2nd grade.

8th Septembcr, 1897.—No. 5059.—The Chief Commissioner is pleased to appoint Mr. Narayan Pershad Bajpai, Forest Ranger, 2nd grade, to be an Extra-Assistant Conservator of Forests 4th grade, with effect from the 6th June 1896, to fill an existing vacancy.

8th September 1897.—No. 17.—The privilege leave for 15 days granted to Mr. R. H. Cole, Ranger. 4th grade, Direction Division, by Department Order No. 11, dated the 21st August 1897, is extended by five days.

8th September, 1897.—No. 18.—With reference to Departmental Order No. 10, dated the 16th August 1897, Mr. A. T. C. Howell, Forlest Ranger, 1st grade, Nimar Division, having returned from privilege eave on the 26th August 1897, in the forenoon, the unexpired portion of his leave is hereby cancelled.

13th September 1897.—No. 4166.—Mr. A. St. V. Beechey, Assistant Conservator of Forests, was placed on special duty in the Forest Divisional Office, Chanda, from the 17th to the 21st November 1896.

15th September 1897 —No. 4210.—With reference to Notification No. 871— 221-4F, dated the 8th instant, of the Government of India, in the Revenue and Agricultural Department, Mr. W. P Thomas, Deputy Conservator of Forests, attached to the Direction Division on special duty, was relieved of his duties at Jubbulpore on the afternoon of the 28th ultimo.

He assumed charge of the office of Conservator, Southern Circle, from Mr. J. A. McKee, on the afternoon of the 1st instant.

15th September 1897.—No 19.—Privilege leave for one month and thirteen days, under Article 291 of the Civil Service Regulations, is granted to Mr. R. N. Thompson, Ranger, 4th grade, Betul Forest Division, with effect from the 12th September 1897.

22nd September 1897.—No. 4263.—*Erratum.*—In Order No. 4058 dated the 8th instant, *for* "Messrs. C. K. Chatterji and Mansukh Rai, Extra-Assistant Conservators of Forests, 2nd grade," *read* "Messrs. C. K. Chatterji and Mansukh Rai, Extra-Assistant Conservators of Forests, 1st grade."

28th September 1897.—No. 4339.—With reference to Order No. 4055, dated the 8th instant, Mr. H. E. Bartlett, Assistant Conservator of Forests, and Mr M. Muttanah Extra Deputy Conservator of Forests respectively made over and assumed charge of the Hoshangabad Forest Division on the forenoon of the 9th idem.

28th September 1897.—No. 4340.—Mr. G. P. Taylor, Deputy Conservator of Forests, Saugor, availed himself, on the forenoon of the 11th instant. of the three months' privilege leave granted him by Order No. 4053, dated the 8th idem, making over charge of the Saugor Forest Division to Mr. H. E. Bartlett, Assistant Conservator of Forests.

30th September 1897.—No 4350.—Mr. N. C. McLeod, Extra-Assistant Conservator of Forests, 2nd grade, Bilaspur, has been placed on special famine duty in that district.

He assumed charge of his duties on the forenoon of the 24th June 1897.

30th September 1897.—No. 4374.—Mr. Ramchandra Krishna, Extra Assistant Conservator of Forests, was attached to the Direction Division, Nagpur, on special duty, from the 21st to the 23rd March last both days inclusive.

25th September 1897.—No. 20.—The privilege leave for three months granted to Ilahidad Khan, Officiating Forest Ranger, 6th grade, by Departmental Order No. 7, dated the 23rd July 1897, is commuted to leave on medical certificate under Article 343 of the Civil Service Regulations and is extended by two months.

3.—BURMA GAZETTE.

27th August 1897.—No. 23.—Mr. W. R. French, Supernumerary Forest Ranger, 3rd grade, reported his arrival at Rangoon on the morning of the 15th July 1897 and took charge of the Mogaung range of the Katha Division from Mr. T. W. Forester, Supernumerary Extra Assistant Conservator of Forests, on the afternoon of the 11th August 1897.

3rd September 1897.—No. 307.—Messrs C. W. B. Anderson and C. S. Rogers are promoted from the 4th to the 3rd grade of Extra Assistant Conservators of Forests.

6th September 1897.—No. 308.—On his return from leave Mr. C. M. Hodgson, Deputy Conservator of Forests, is posted to Mandalay as Personal Assistant to the Conservators, Eastern and Western Circles.

7th September 1897.—No. 309.—Mr. H. Jackson, Deputy Conservator of Forests, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

9th September 1897.—No. 310.—The following temporary alterations in rank are ordered in the Forest Department :—

(1) With effect from the 16th June 1897, consequent on the departure on privilege leave of Mr. E. S. Carr, Deputy Conservator.

Mr. J. Copeland, Deputy Conservator, 2nd grade, to officiate as Deputy Conservator, 1st grade.

Mr. H. Carter, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator 2nd grade.

Mr. C. B. Smales, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to officiate as Deputy Conservator, 3rd grade.

(2) With effect from the 22nd August 1897, consequent on the return of Mr. H. Calthrop from privilege leave.

Mr. H. Carter, Officiating Deputy Conservator, 2nd grade, to revert to his substantive appointment.

10th September 1897.—No. 315.—E. M. Buchanan, Extra Deputy Conservator of Forests, was placed on special duty in Rangoon from the 23rd June to the 2nd July 1897, both days inclusive.

13th September 1897.—No. 25.—With reference to Revenue Department Notification No. 308 (Forests), dated the 6th September 1897, Mr. C. M. Hodgson, Deputy Conservator of Forests, assumed charge of his duties as Personal Assistant to the Conservators of Forests, Eastern and Western Circles, on the afternoon of the 9th September 1897.

21st September 1897.—No. 322.—Mr. A.M. Burn-Murdoch, Deputy Conservator of Forests, is transferred from Toungoo and posted to the charge of the Prome Forest Division.

Mr. Burn-Murdoch will continue to hold charge of the Working Plans Division, Tenasserim Circle, in addition to his other duties.

No. 323.—On return from furlough Mr. H. Jackson, Deputy Conservator of Forests, is posted to the charge of the Lower Chinddwin Forest division.

No. 324.—On return from privilege leave Mr. E. S. Carr, Deputy Conservator of Forests, is posted to the charge of the Bhamo forest division.

No. 325.—On being relieved by Mr. Jackson, Mr. S. Carr, Deputy Conservator of Forests, will continue in charge of the Pyinmana Working Plans division.

27th September, 1897.—No. 24.—With reference to Revenue Department Notification No. 308 (Forests), dated the 6th September 1897, Mr. C. M. Hodgson, Deputy Conservator of Forests, reported his arrival at Mandalay on the afternoon of the 9th September 1897, for the assumption of his duties as Personal Assistant to Conservator of Forests Eastern and Western Circles.

27th September, 1897.—No. 25.—Mr. C. M. Hodgson, Deputy Conservator of Forests, assumed charge of the Direction Division, Eastern Circle, on the noon of the 27th September 1897.

9—ASSAM GAZETTE

2nd September, 1897.—No. 6039G,—Mr. H. G. Young, Deputy Conservator of Forests, in charge of the Lakhimpur Forest Division, is placed in charge of the Sibsagar Forest Division, in addition to his own duties, until further orders.

24th September, 1897.—No. 6750G.—Privilege leave of absence for one month and fifteen days, under article 291 of the Civil Service Regulations, is granted to Babu Tara Kisor Gupta, Extra Assistant Conservator of Forests, in charge of the Nowgong Forest Division, with effect from the 1st October 1897, or the subsequent date on which he may avail himself of it.

24th September, 1897.—No. 6751G.—Mr. D. P Copeland, Deputy Conservator of Forests, in charge of the Darrang Forest Division, is placed in charge of the Nowgong Forest Division, in addition to his own duties, during the absence on leave of Babu Tara Kisor Gupta, or until further orders.

10—HYDERABAD RESIDENCY GAZETTE.

3rd September, 1897.—No. 237. With reference to *Residency Orders* Notification No. 206, dated the 28th July 1997 it is notified that Mr. B. Bhukan, Extra Assistant Conservator of Forests, on being relieved of the charge of the Buldana Division on the afternoon of the 11th June 1897, was attached to the Direction Division from the 16th to the 24th June 1897, on the afternoon of which latter date he assumed charge of the Amraoti Division.

27th September, 1897.—No. 261.—The Resident is pleased to make the following promotions consequent on the appointment of Messrs. C. K. Chatterji and Mansukh Rai, Extra Assistant Conservator of Forests, 1st grade, to fill appointments Nos. 36 on the Imperial List, and with reference to Notification No 4058, dated the 8th September 1897, published at page 195 of Part II of the *Central Provinces Gazette* dated the 11th September 1897 :—

Mr. Srinivasalu Naidu, Extra Assistant Conservator of Forests, 4th grade, to be Extra Assistant Conservator of Forests, 3rd grade, with effect from the 6th June 8897.

Mr. L. K. Martin, Extra Assistant Conservator of Forests, 4th grade, to be Extra Assistant Conservator of Forests, 3rd grade, with effect from the 21st September 1896, the date on which he qualified for promotion.

11—MYSORE GAZETTE.

10th September 1897.—No. 2751—*Ft. F.* 27-95.—Mr Y. Sitiramaiya, Assistant Conservator of Forests, on Special Duty, Kadur district, is temporarily transferred to the Shimoga district, for Special Duty under the immediate orders of the Deputy Commissioner.

10th September 1897 —No. 2754.—*Ft. F.* 1-96.—Under Article 172 of the Mysore Service Regulations, Mr. P E. Benson Sub-Assistant Conservator of Forests attached to the Shimoga district, was granted casual leave of absence for six days from the 26th August 1897.

18th September 1897.—No 3021.—*Ft. F.* 7-96 —Under Article 171 of the Mysore Service Regulations, Mr. J J. Monteiro, Extra Assistant Conservator of Forests, Sorab Range, Shimoga district, was granted casual leave of absence for five days with effect from the 25th August 1897.

27th September 1897.—3342.—*Et. F.* 62-95.—Under Article 171 of the Mysore Service Regulations, Mr M G. Rama Rao, Officiating Assistant Conservator of Forests, Mysore District, was granted casual eave of absence for four days with effect from the 8th instant.

28th September 1897, No. 3366 —*Ft. F* 27-95.—The following transfers of Deputy Conservators of Forests are ordered :—

Mr, C. Narain Rao, from Shimoga to Mysore

Mr. T. Abdul Karim, from Mysore to Shimoga.

VIII—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.—*Nil*.

2—MADRAS GAZETTE.

2nd October 1897.—No 463.

No.	Name of Officers.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	M. R Ry. C. M. Maduranayagam Pillai Avargal	Ranger, 1st Grade Central Circle.	Extra Assistant Conservator of Forests 4th Grade	Acting. ...	During the absence of Mr. W. Carroll on leave, or until further orders.

11th October 1897.—No. 478.

Name of officer.	Present grade	Grade to which promoted	Nature of promotion.	Remarks showing cause of vacancy, &c.
Mr. F. C. L. Cowley-Brown.	Assistant Conservator of Forests, 1st Grade, and Ag. Dy. Conservator 4th Grade.	Dy. Conservator of Forests 4th Grade.	Permanent	In the vacancy caused by the retirement of Mr. J. H. B. Brougham and by the promotion of Mr. P. M. Lushington to the 3rd Grade.

11th October 1897.—*Departmental Examination.*—The following candidates have passed the Departmental Examination held on 19th July, 1897 in the subjects mentioned against each :—

1.	M. Kissen Sing ..	Forest Act & Rules, Code and Accounts.
2.	D. Ramamurti ...	Code and Accounts.
3.	A. Peterson ...	Forest Act & Rules, Code and Accounts.
4.	V. S. Subramania Iyer	Code and Accounts.
5.	N. Nagayacharlu ...	Forest Act & Rules, Code and Accounts.
6.	V. Narayana Iyer ...	Forest Act and Rules.
7.	C. A. Natesa Iyer ...	Do.
8.	S. Hanumanthu ...	Code and Accounts.
9.	S. Subba Row ...	Forest Act and Rules.

17th October 1897.—Leave—Mr. W. A. Newman, Ranger, Godavari District, is granted privilege leave of absence for three months, with effect from the date of relief.

22nd October 1897.—No. 489.—

Name and designation of Officer.	District.	Nature of charge	Remarks.
Mr. H. F. A. Wood, Assistant Conservator of Forests, 1st Grade, and Acting Deputy Conservator of Forests, 4th Grade.	Madura ..	To do duty under the orders of the District Forest Officer.	On relief by Mr. R. J. A. Porter.

26th October 1897.—No. 486.—Mr C. D. McArthy, District Forest Officer, North Arcot, is granted privilege leave for one month and twelve days, with effect from or after the 8th November 1897, under article 291 of the Civil Service Regulations.

29th October 1897.—No. 491.—Mr H. H. Ward, Extra Assistant Conservator of Forests, Godavari, is granted privilege leave for two months with effect from or after the 1st November 1897, under article 291 of the Civil Service Regulations.

3.—BOMBAY GAZETTE.

1st October 1897.—No. 3815.—Messrs. V. M. Tilak and W. R. Govande, Extra Assistant Conservators, repectively delivered over and received charge of the Sub-division Forest Office, Poona, on the 25th September, 1897, in the afternoon.

4th October 1897.—No. 7318.—Mr. R. C. Wroughton, Conservator of Forests, N. C., is allowed privilege leave of absence for three months.

11th October 1897.—No. 7446.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. C. Greatheed, on return from leave, to be Divisional Forest Officer, Ahmednagar.

Mr. W. F. D. Fisher to be Working Plans Officer, Northern Circle.

Mr. G. P. Millett, on relief, to be Divisional Forest Officer, Nasik.

Mr. D A Thomson to be Divisional Forest Officer, Surat.

13th October 1897.—No 7501.—His Excellency the Governor in Council is pleased to appoint Mr. S. Hornidge, A. M I. C. E., on relief by Mr. Greatheed, to be Divisional Forest Officer, Sholapur.

23rd October 1897.—No 7807A—Mr. Savalaram Balwant Ranade, Sub-Divisional Forest Officer, Panch Mahals, passed an examination in Gujarati according to the Lower Standard on the 6th October, 1897.

Mr. E M. Hodgson, Assistant Conservator of Forests, Poona, passed an examination in Marathi according to the Lower Standard on the 6th October, 1897.

Mr. D. A. Thomson, Assistant Conservator of Forests, N. D. Kanara, passed an examination in Kanarese according to the Higher Standard on the 6th October, 1897.

23rd October 1897—No. 7828—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. F. R. Dasai to act as Conservator of Forests, Second Grade, during the absence of Mr. Wroughton on leave

Mr. W. G Betham to act as Conservator of Forests, Third Grade during the same period.

4.—BENGAL GAZETTE.

29th October 1897.—No. 3189.—Mr E. P. Stebbing, Officiating Assistant Conservator of Forests, 1st grade, having availed himself of the three months' privilege leave granted him in Notification No 2576 For., dated the 24th August, 1897 with effect from the 6th September, 1897, the following temporary promotion is made:—

Mr. H. A. Farrington, Assistant Conservator, 2nd grade, to officiate in the 1st grade of Assistant Conservators of Forests.

5.—N.-W. P. AND OUDH GAZETTE.

6th October 1897.—No $\frac{2857}{\text{II-403 c}}$. Mr. A. G. Hobart-Hampden, Deputy Conservator of Forests, Ganges Division Central Forest Circle, furlough out of India for two years with effect from the date on which he is relieved by Mr Lovegrove.

6th October 1897.—No $\frac{2837}{\text{II-86 c}}$. Babu Nand Mal, Extra Assistant Conservator of Forests, on return from privilege leave, to the Gorakhpur Division as a temporary measure.

6th October 1897.—No $\frac{2843}{\text{II-532 B}}$. Mr. B. A. Rebsch, Deputy Conservator of Forests, on return from leave, to the Kumaun Division.

6th October 1897.—No. $\frac{2826}{\text{II-665 B}}$. With effect from the 1st September, 1897

Pandit Sadanand Gairola, Extra Assistant Conservator of Forests, 3rd Grade, *Sub-pro-tem*, to be confirmed in that grade.

6th October 1897.—No. $\frac{2825}{\text{II-665 B}}$. With effect from the 1st September, 1897.

Mr. E. L. Haslett, Extra Assistant Conservator of Forests, from the 3rd to the 4th grade.

6th October 1897.—No. $\frac{2846}{\text{II-585 B}}$. Pandit Rama Dat, Extra Assistant Conservator of Forests, from the Jaunsar to the Garhwal Division.

6th October 1897.—No. $\frac{2847}{\text{II-585 B}}$. Mr. W. A. R Doxat, Assistant Conservator of Forests, form the Garhwal to the Bahraich Division.

6th October 1897 —No. $\frac{2848}{\text{II-585 B}}$. Babu Nand Mal, Extra Assistant Conservator of Forests, from the Gorakhpur to the Kumaun Division.

6th October 1897.—No. $\frac{2849}{\text{II-585 B}}$. Mr. F. F. R. Channer, Assistant Conservator of Forests, from the Kumaun to the Kheri Division.

6th October 1897.—No $\frac{2844}{\text{II-585 B}}$ Mr. R. C. Milward, Assistant Conservator of Forests on being relieved by Mr Rebsch, from the charge of the Kumaun Division, to the charge of the Dehra Dun Division.

6th October 1897.—No $\frac{2845}{\text{II-585 B}}$: Mr. W. H. Lovegrove, Deputy Conservator of Forests, on being relieved by Mr. Milward, from the Dehra Dun to the Ganges Division.

11th October 1897.—No. $\frac{2979}{\text{II-585 B}}$: Mr. E. L. Haslett, Extra Assistant Conservator of Forests, from the Jaunsar to the Naini Tal Forest Division.

16th October 1897.—No. $\frac{3022}{\text{II-585 B}}$: Notifications Nos. $\frac{2846}{\text{II-585 B}}$: and No. $\frac{2847}{\text{II-585 B}}$: dated 6th October, 1897, transferring Pandit Rama Dat and Mr. Doxat, are hereby cancelled.

6.—PUNJAB GAZETTE.

1st October 1897.—No. $\frac{485}{\text{A. L. No. 23}}$.—The following changes have taken place in the list of Forest Officers on the Associated Provinces with effect from the date specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. St. V. Beechy ...	Assistant Conservator 2nd Grade.	Sub. *Pro tem.* Assistant Conservator, 1st Grade.	5th July, 1897 ...	To fill up an existing vacancy.
Mr. W. Mayes ...	Assistant Conservator 2nd Grade,	Officiating Assistant Conservator, 1st Grade.	14th July, 1897 ...	Consequent on Mr. Somers Smith officiating in 4th Grade of Deputy Conservators.

7th October 1897.—No $\frac{496}{\text{A. L. No. 24}}$.—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the dates specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted	With effect from.	REMARKS.
Mr. G. G. Minniken	Officiating Conservator. 3rd Grade.	Deputy Conservator, 1st Grade	23rd September, 1897.	Consequent on the return of Mr. C. F. Elliott from privilege leave.
Mr. J. H. Lace ...	Officiating Deputy Conservator, 1st Grade.	Deputy Conservator, 2nd Grade.	Ditto.	
Mr. F. C. Hicks ...	Officiating Deputy Conservator, 2nd Grade.	Deputy Conservator, 3rd Grade.	Ditto.	
Mr. C. Somers Smith ...	Officiating Deputy Conservator, 3rd Grade.	Provisional Deputy Conservator, 4th Grade.	Ditto.	
Mr. C. M. McCrie. ...	Officiating Deputy Conservator, 4th Grade.	Provisional Assistant Conservator, 1st Grade.	Ditto.	

8th October 1897.—No. $\frac{502}{\text{A. L. No 25}}$.—The following charges have taken place in the list of Forest Officers in the Associated Provinces with effect from the dates specified against each

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from	REMARKS.
E. A. Down	Deputy Conservator, 2nd Grade	Officiating Deputy Conservator, 1st Grade.	7th September 1897.	Consequent on the retirement of Mr. E. Dobbs from the service.
L. G. Smith	Sub *pro tem.* Deputy Conservator, 2nd Grade	Deputy Conservator, 2nd Grade (permanent)	Ditto.	
F. S. Barker	Officiating Deputy Conservator, 2nd Grade.	Sub *pro tem.* Deputy Conservator, 2nd Grade.	Ditto.	
H. A. Hoghton	Deputy Conservator, 3rd Grade.	Officiating Deputy Conservator, 2nd Grade	Ditto.	
F. C. Hicks	Sub. *pro tem.* Deputy Conservator, 4th Grade.	Deputy Conservator, 3rd Grade (permanent).	Ditto.	
A. E. Lowrie	Officiating Deputy Conservator, 3rd	Sub *pro tem* Deputy Conservator, 3rd Grade.	Ditto.	
A. W. Blunt	Deputy Conservator, 4th Grade.	Officiating Deputy Conservator, 3rd Grade.	Ditto.	
A. M. F. Caccia ...	Sub. *pro tem* Deputy Conservator, 4th Grade.	Deputy Conservator, 4th Grade (permanent).	Ditto.	
C. Somers Smith ...	Officiating Deputy Conservator, 4th Grade.	Sub *pro tem.* Deputy Conservator, 4th Grade	Ditto.	
A. H. V. Beechy ...	Sub. *pro tem.* Assistant Conservator, 1st Grade.	Assistant Conservator, 1st Grade (permanent), and Officiating Deputy Conservator, 4th Grade.	Ditto.	
C. M. McCrie	Officiating Assistant Conservator, 1st Grade.	Sub. *pro tem* Assistant Conservator, 1st Grade.	Ditto.	

8th October 1897.—No. $\frac{503}{\text{A. L. No. 26}}$.—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the dates specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
J. H. Lace	Deputy Conservator, 2nd Grade.	Officiating Deputy Conservator, 1st Grade.	9th September 1897.	Consequent on Mr. F. O Lemarchand's going on two months' privilege leave.
F. C. Hicks	Deputy Conservator, 3rd Grade	Officiating Deputy Conservator, 2nd Grade.	Ditto	
C. Somers Smith ...	Sub. *pro tem* Deputy Conservator, 4th Grade	Officiating Deputy Conservator, 3rd Grade.	Ditto.	
C. M. McCrie	Sub. *pro tem.* Assistant Conservator, 1st Grade.	Officiating Deputy Conservator, 4th Grade.	Ditto.	

10*th October* 1897.—No. $\frac{507}{\text{A. L. N. 27}}$.—Mr. G. G Minniken Deputy Conservator of Forests is appointed Political Assistant to the Superintendent of Hill States, Simla with effect from the afternoon of the 15th September 1897, in place of Mr. G. S. Hart, transferred.

10*th October* 1897.—No. $\frac{511}{\text{A. L. No. 28}}$.—Mr. G. G. Minniken, Officiating Conservator of Forests, Punjab, took over charge of the Bashar Forest Division at Simla, in addition to his own duties, on the afternoon of the 15th September 1897 relieving Mr. G. S. Hart, Deputy Conservator of Forests, transferred to officiate as Assistant Inspector-General of Forests and Superindent of Working Plans.

14*th October* 1897—No. $\frac{531}{\text{A. L No 29.}}$—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the dates specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from	REMARKS.
Mr. J. A Lace	Deputy Conservator, 2nd Grade.	Officiating Deputy Conservator, 1st Grade.	2nd Oct. 1867	Consequent on Mr. Thomas promotion to Officiating Conservator of Forests *vice* Mr. McKee on three months' privilege leave from September 1st 1897.
Mr. F. C. Hicks. ...	Deputy Conservator, 3rd Grade	Officiating Deputy Conservator, 2nd Grade	Ditto.	
Mr. C. Somers Smith	Provisional Deputy Conservator, 4th Grade.	Officiating Deputy Conservator, 3rd Grade.	Ditto.	
Mr. C. M. McCrie ...	Provisional Assistant Conservator. 1st Grade,	Officiating Deputy Conservator, 4th Grade.	Ditto.	

16*th October* 1897.—No.—$\frac{540}{\text{A. L. No 30.}}$—*Promotion.*—Mr. C. M. McCrie having passed in all subjects prescribed by Section 72 of Forest Department Code, is promoted to Officiating Assistant Conservator, 1st Grade, with effect from the 7th September 1897, the date on which he passed his examinations, to fill an existing vacancy.

22nd October 1897.—No. $\frac{558}{\text{A L No. 81}}$.—The following changes have taken place in the list of Forest Officers in the Associated Provinces, with effect from the dates specified against each :—

Names.	Present Grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. C. M. McCrie	Officiating Deputy Conservator, 4th Grade.	Provisional Assistant Conservator 1st Grade.	11th October 1897.	Consequent on the return of Mr. E. M. Coventry from three months' privilege leave on afternoon of 8th October 1897.
Mr. A. E. Lowrie	Provisional Deputy Conservator, 3rd Grade.	Officiating Deputy Conservator 2nd Grade.	Ditto ...	Consequent on Mr G. F. Taylor going on three months' privilege leave from forenon of 11th Septr. 1897.
Mr. E. M. Coventry	Officiating Deputy Conservator, 4th Grade.	Officiating Deputy Conservator, 3rd Grade.	Ditto ...	
Mr. C. M. McCrie	Provisional Assistant Conservator, 1st Grade.	Officiating Deputy Conservator, 4th Grade.	Ditto ...	

29th October 1897 —*Addendum* —To Punjab Government Notification No. $\frac{503}{\text{A. L. No. 26}}$, dated 8th October 1897, add the following :—

"This Notification is published in supersession of Notification No. $\frac{462}{\text{A. L. No. 22}}$ of 17th September 1897.

7.—CENTRAL PROVINCES GAZETTE.

1st October 1897.—No. 4392 —Privilege leave for 28 days is granted to Mr. F. O. Lemarchand, Deputy Conservator of Forests, Chanda, in extension of the two months' privilege leave granted him by Order No. 3452, dated the 20th July, 1897.

7th October 1897.—No. 21.—Shyam Sundar Lal, Forest Ranger, 6th grade, in the Hoshangabad Forest Division, is granted fifteen days' privilege leave, under Article 291 of the Civil Service Regulations, with effect from the 16th October, 1897.

12th October 1897.—No 22,—Privilege leave for one month and fifteen days under Article 291 of the Civil Service Regulations, is granted to Jairam Raghunath, Ranger, 5th grade, Permanent Establishment, Mandla Forest Division. with effect from the 20th October, 1897, or such subsequent date as he may be permitted to avail himself of it.

14th October 1897.—No. 4531.—Dr. E, Dobbs, Deputy Conservator of Forests, having been declared unfit for further service by a Medical Board, was permitted, in anticipation of the sanction of the Government of India, to retire from the service on the forenoon of the 7th September 1897, making over charge of the Nagpur-Wardha Division to Mr. C. K. Chatterjee, Extra-Assistant Conservator of Forests.

Mr. C. K. Chatterjee, will, until further orders, hold charge of the Nagpur-Wardha Division in addition to the charge of the Bhandara Forest Division.

14th October 1897.—No. 23.—In consequence of the re-organization of the Subordinate Forest Establishment recently sanctioned by the Government of India in their letter No. $\frac{101}{276-12}$F. of the 25th January, 1897, the following promotions and appointments are ordered with effect from the 1st January, 1897, with the Chief Commissioner's previous sanction :—

Name.	GRADE.		Circle.	Nature of promotion and other remarks.
	From	To		
Mr. Syed Ali Muttaki ..	2nd grade on Rs 120	2nd grade on Rs 125	Northern Circle	Substantive (Seconded.)
,, Narain Perahad	Do do ..	Do do ..	Southern do	Substantive.
,, A. T. C. Howell	Do do (sub. *pro tem*)	Do do .	Northern do	Do
,, W. G. Gilmore..	3rd grade on Rs 100	Do do ..	Southern do	Sub. *pro tem.*
,, Ganga Perahad	Do do (sub. *pro tem.*	3rd grade on Rs 100	Do do	Substantive.
,, I. Shama Rao ..	4th grade on Rs 80	Do do ..	Do do	Do
,, A. Hunt ..	Do do ..	Do do ..	Do do	Substantive (Seconded)
,, A. Ponnuswamy	Do do ..	Do do ..	Do do	Substantive.
,, Faiz Baksh ..	Do do ..	Do do ..	Northern do	Sub *pro tem.*
,, Amrit Lal Chatterjee ..	Do do ..	Do do ..	Do do	Substantive.
,, D. N. Avasia .	Do do (sub *pro tem*)	4th grade on Rs 80	Southern do	Substantive.
,, Chhoga Lal ..	Do do (officiating).	Do do ..	Do do	Do
,, J. F. Anthony	5th grade on Rs 60	Do do ..	Northern do	Do
,, P. Shankarnath	Do do ..	Do do ..	Do do	Do
,, J. D. St. Joseph	Do do ..	Do do ..	Do do	Do
,, Govind Rao Tolay ..	Do do Rs 70	Do do ..	Southern do	Sub. *pro tem.*
,, Gauri Shankar	Do Rs 60 ..	Do do ..	Northern do	Do
,, Bhaya Lal Dubey ..	6th grade on Rs 50	5th grade on Rs 60	Do do	Substantive.
,, D. Raja Rao ..	Do do ..	Do do ..	Southern do	Do
,, K. Rama Rao ..	Do do ..	Do do ..	Do do	Sub. *pro tem.*
,, F. J. Langhorne	Do do ..	Do do ..	Do do	Do
,, Vinayak Chimnaji Bhagwat..	Do do (sub. *pro tem.*)	6th grade on Rs 50	Northern do	Substantive.
,, C. C. Gilmore ..	Do do (temporary)	Do do ..	Southern do	Substantive (Seconded).
,, S. N. Chatterjee	Do do (do)	Do do ..	Northern do	Substantive
,, E. A Rooke ..	Do do (do)	Do do ..	Southern do	Do
,, Chintaman Vishwanath Sarwate ..	Do do (do)	Do do ..	Northern do	Do
,, Jairam Raghunath ..	Do do (do)	Do do ..	Do do	Sub. *pro tem.*
,, Thakur Perahad	5th grade on Rs 60 (do)	Do do ..	Do do	Do

The Notifications published in the *Central Provinces Gazette*, Part II, Section II B, of the 19th, 22nd and 29th May 1897, are hereby cancelled.

No 24.—In consequence of the re-organization of the Subordinate Forest Establishment recently sanctioned by the Government of India in their letter No. $\frac{101}{276-12}$F of the 25th January 1897, the following promotions and appointments are ordered with effect from the 1st March, 1897, with the Chief Commissioner's previous sanction :—

Name.	Grade.		Circle.	Nature of promotion and other remarks.
	From	To		
Mr. Narain Pershad	2nd grade on Rs 125	1st grade on Rs 150	Southern Circle	Substantive.
,, W. G. Gilmore ..	Do do (sub *pro tem.*)	Do do ..	Do do	Do
,, Ganga Pershad	3rd grade on Rs 100	2nd grade on Rs 125	Do do	Do
,, I. Shama Rao ..	Do do ..	Do do ..	Do do	Do
,, A. Hunt ..	Do do ..	Do do ..	Do do	Sub *pro tem.*, (Seconded)
,, A. Ponnuswamy	Do do	Do do ..	Do do	Sub *pro tem.*
,, Faiz Baksh ..	Do do (sub *pro tem.*)	3rd grade on Rs 100	Northern do	Substantive.
,, Amrit Lal Chatterjee	Do do ..	Do do ..	Do do	Do
,, F. W. Wightman	4th grade on Rs 80	Do do ..	Southern do	Do
,, D. N. Avasia .	Do do ..	Do do ..	Do do	Do
,, J. F Anthony	Do do ..	Do do ..	Northern do	Sub *pro tem.*
,, P. Shankarnath	Do do .	Do do ..	Do do	Do
,, Bhagwant Narain Deshpande	5th grade on Rs 60	4th grade on Rs 80	Do do	Substantive.
,, R. H Cole ..	Do do ..	Do do ..	Do do	Do
,, Govind Rao Tolay	4th grade on Rs 80 (sub *pro tem.*)	Do do ..	Southern do	Do
,, Gauri Shankar	Do do ..	Do do ..	Northern do	Do
,, D. Raja Rao ..	5th grade on Rs 60	Do do ..	Southern do	Do
,, K. Rama Rao ..	Do do (sub *pro tem*)	Do do ..	Do do	Do
,, F. J. Langhorne	Do do ..	Do do ..	Do do	Do
,, R. N. Thompson	Do do ..	Do do ..	Northern do	Do
,, Bhaya Lal Dubey	Do do ..	Do do ..	Do do	Do
,, Mathura Parshad	Do do ..	Do do ..	Southern do	Sub *pro tem.*
,, N. C. Chatterjee	6th grade on Rs 50	Do do ..	Do do	Do
,, Dinkar Vishnu Pranjpe	Do do .	5th grade on Rs 60	Do do	Substantive.
,, Vinayak Chimnaji Bhagwat	Do do ..	Do do ..	Northern do	Do
,, *O. C. Gilmore* ..	*Do do* ..	*Do do* ..	*Southern do*	*Substantive (Seconded.)*
,, S. N. Chatterjee	Do do ..	Do do ..	Northern do	Do
,, E. A. Rooke ..	Do do ..	Do do ..	Southern do	Do
,, Chintaman Vishwanath Sarwate	Do do ..	Do do ..	Northern do	Sub *pro tem.*
,, Jairam Raghunath	Do do (sub *pro tem*)	Do do ..	Do do	Do
,, Matadin Dubey	Do do ..	Do do ..	Southern do	Do
,, Dhondu Narayan Deshpande	Forester, 1st grade (old style.)	6th grade on Rs 50	Northern do	Substantive.
,, Shyam Sunder ..	Do do ..	Do do ..	Do do	Sub *pro tem.*
,, Rahidad Khan ..	6th grade on Rs 50 (temporary.)	Do do ..	Do do	Officiating.

No. 25.—The following changes have taken place in the list of Forest Rangers in the Central Provinces with effect from the dates specified against each :—

Name.	Present grade.	Grade to which promoted.	With effect from—	Remarks.
Mr. A. T. C. Howell	2nd grade .	Sub *pro tem.* 1st grade	17th March 1897	Consequent on the deputation of Mr. W C Gilmore, Forest Ranger, 1st grade, on foreign service. (Seconded)
" S. R. Parsons	3rd grade ..	Do 2nd do	Do ..	
" Chhoga Lal ..	4th grade ..	Do 3rd do	Do	
" W. J. Anthony	6th grade ..	Do 4th do	Do ..	
" Ghanshyam Parshad	Do ..	Do 5th do	1st April 1897	
" Shyam Sundar	Sub *pro tem* 6th grade	Confirmed 6th do	Do .	
" Chintaman Vishwanath Sarvate	Do 5th grade	Do 5th do	16th April 1897	Consequent on the retirement of Abdul Ali, Forest Ranger, 5th grade.
" W. G. Slaney	6th grade ..	Sub *pro tem.* do do	Do ..	
" Thakur Parshad	Sub *pro tem.* 6th grade	Confirmed 6th do	Do ..	
" Mathura Parshad	Do 4th grade	Do 4th do	18th April 1897	Consequent on the resignation of Raja Rao, Ranger, 4th grade.
" Dinkar Vishnu Paranjpe	5th grade	Sub *pro tem.* do do	Do ..	
" Jairam Raghunath	Sub *pro tem.* 5th grade	Confirmed 5th do	Do ..	
" Shyam Sundar	6th grade ..	Sub *pro tem* do do	Do ..	
" A. Hunt ..	Sub *pro tem.* 2nd grade	Confirmed 2nd do (Seconded)	16th June 1897	Consequent on the death of Ali Mutaki, Ranger, 2nd grade.
" J. F. Anthony	Do 3rd grade	Confirmed 3rd do	Do ..	
" N. C. Chatterjee	Do 4th grade	Do 4th do	Do ..	
" Matadin Dube	Do 5th grade	Do 5th do	Do ..	

8.—Burma Gazette.

1st October, 1897.—No. 26.—Mr. C. M. Hodgson, Deputy Conservator of Forests, received charge of the Direction Division, Eastern Circle, from Mr. J. Nisbet, Officiating Conservator of Forests, on the afternoon of the 1st instant.

This cancels this office Notification No. 25, dated the 27th September, 1897.

2nd October, 1897.—No. 19.—With reference to Revenue Department Notification No. 322 (Forests), dated the 21st September, 1897, Mr. G. Q. Corbett, Deputy Conservator of Forests, and Mr. A. M. Burn-Murdoch, Deputy Conservator of Forests, respectively made over and received charge of the Prome Division on the forenoon of the 1st instant.

2nd October, 1897.—No. 26 —With reference to Revenue Department Notification No. 323 (Forests), dated the 21st September, 1897 Mr. S. Carr, Deputy Conservator of Forests, made over, and Mr H. Jackson, Deputy Conservator of Forests, received charge of, the Lower Chindwin Division on the afternoon of the 2 th September, 1897.

7th October, 1897.—No. 328.—Mr. W A. Hearsey, Extra Assistant Conservator of Forests is transferred from Bhamo to the charge of the Kyauksè subdivision of the Mandalay forest division.

7th October, 1897.—No. 339.—On being relieved by Mr Hearsey, Mr. C. W. Doveton, Assistant Conservator of Forests, is posted to the charge of the Gangaw subdivision of the Yaw forest Division.

7th October 1897.—No. 27.—With reference to Revenue Department Notification No. 324 (Forests) dated the 21st September, 1897, Mr. E. S. Carr, Deputy Conservator of Forests, reported his return from the three months and 15 days privilege leave granted him in Revenue Department Notification No 191 (Forests), dated the 31st May, 1897, and resumed charge of the Bhamo division from Mr. W. A. Hearsey, Extra Assistant Conservator of Forests, on the forenoon of the 1st instant.

8th October 1897.—No 346.—Mr. J. Messer, Deputy Conervator of Forests, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

14th October 1897.—No. 353.—The privilege leave granted to Mr. J. W Ryan, Extra Assistant Conservator of Forests, in this department Notification No 260, dated the 30th July, 1897, is commuted to leave on medical certificate under Article 369 of the Service Regulations for three months and 28 days

25th October 1897—No. 363.—On his return from furlough Mr. J. Messer, Deputy Conservator of Forests, is posted to the charge of the Katha Forest division.

9.—ASSAM GAZETTE.

No. 364—On being relieved by Mr. Messer, Mr. A. E. Rose, Assistant Conservator of Forests, is transferred to the Upper Chindwin Forest division.

11th October 1897.—No. 7409G.—The following is published—

The undermentioned officers have been granted by Her Majesty's Secretary of State for India an extension of leave, or permission to return to duty, as advised in list dated the 10th September 1897 ;

Name	Service.	Appointment.	Period and nature of extension.
Mr. A. M. Long	...	Assistant Conservator of Forests	Six months on medical certificate, subject to confirmation in India.

21st October 1897—No. 7941G—Mr. J. C. Carroll, Assistant Conservator of Forests, on special duty in the Office of the Conservator of Forests, Assam, is re-transferred to the Goalpara Forest Division.

10—HYDERABAD RESIDENCY GAZETTE.

7th October 1897.—No. 272.—The Resident is pleased to declare that at the Departmental Examination held at Amraoti on the 15th September 1897 under section 72 of the Forest Department Code, the undermentioned Forest Officers in the Hyderabad Assigned Districts have passed in the subjects specified against their names:—

Mr. S. L. Kenny, Assistant Conservator of Forests, Hyderabad Assigned Districts.	Forest Law, Hindustani (in colloquial only) by higher standard.

11—MYSORE GAZETTE.

11th October 1897.—No. C. 55—*Ft. F.* 129-95.—Mr. G. E. Ricketts, Assistant Conservator of Forests, is posted to the Mysore district for duty under the District Forest Officer till further orders.

30th October 1897.—No. 3942.—*Ft F.* 1-96.—Under Article 188 of the Mysore Service Regulations, Mr. P. E. Benson, Sub-Assistant Conservator of Forests, Shimoga Range, was granted privilege leave of absence for twenty-two days, with effect from the 23rd September, 1897.

VIII—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.—*Nil.*

2.—Madras Gazette

1st *November*, 1897.—*Promotion*.—Ranger G W. Thompson to be Ranger, Fourth Grade, sub *pro tem*, from 1st November, 1897, *vice* J. Tapp on foreign service.

APPOINTMENTS

2nd *November*, 1897 —No. 495 —

No.	Name of officer	Present grade	Grade to which promoted.	Nature of promotion	Remarks showing cause of vacancy, &c
1	Mr W W Bachelor	Asst Con of Forests, 2nd Grade, & acting in 1st Grade.	Dy Conservator of Forests, 4th Grade	Acting	During the absence of Mr S. Cox on privilege leave
2	Mr H J A Porter	Deputy Conservator of Forests, 3rd Grade.	Dy Conservator of Forests, 1st Grade	Do	During the absence of Mr. E D M Hooper on leave, or until further orders. To take effect from the date of Mr. Porter's return to duty
3	Mr A W Lushington	Deputy Con of Forests, 3rd Grade, & acting in 2nd Grade	Do	Do	During the absence of No 2 on leave.
4	Mr. E. R Murray	Deputy Conservator of Forests, 3rd Grade	Dy Conservator of Forests, 2nd Grade	Do. .	*Vice* No. 3.
5	Mr. H. B. Bryant	Dy Con of Forests, 4th Grade, & acting in 3rd Grade	Dy. Conservator of Forests, 3rd Grade	Do. ..	*Vice* No. 4 To take effect from the date of Mr. P M Lushington's return from privilege leave.
6	Mr. P M Lushington	Dy Conservator of Forests, 3rd Grade.	Dy Conservator of Forests, 2nd Grade.	Do.	During absence of Mr A W. Lushington on privilege leave.
7	Mr. H. B Bryant	Dy Conservator of Forests, 4th Grade, and acting in the 3rd Grade.	Dy. Conservator of Forests, 3rd Grade	Do.	During absence of Mr E R. Murray on privilege leave To take effect from date of Mr. Porter's return from furlough.

2nd November 1897.—No. 496.—

No.	Name of officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. H. Tireman. ..	Asst. Conservator of Forests, 2nd Grade, and Acting Dy. Conservator of Forests, 4th Grade.	Asst. Conservator of Forests, 1st Grade.	Permanent.	*Vice* Mr. F. C. L. Cowley-Brown confirmed in the 4th Grade of Deputy Conservator.
2	Do.	Asst. Conservator of Forests, 1st Grade.	Dy. Conservator of Forests 4th Grade.	Acting	

POSTING.

2nd November 1897.—No. 497.—

No.	Name of officer.	District	Nature of charge	Remarks.
	Mr. H F A Wood, Assistant Conservator of Forests, First Grade, and Ag. Deputy Conservator of Forests, Fourth Grade.	North Arcot	Acting District Forest Officer	During the absence of Mr. C. D. McArthy on privilege leave, or until further orders.

5th November 1897.—*Transfer*—Ranger A. N. Hanumantha Row from the Cuddapah district to the South Arcot district.

8th November 1897.—*Appointment.*—A. Venkatanaryaniah, Head Clerk, District Forest office, Cuddapah, to be Forest Ranger, Sixth Grade, sub *pro tem.* in the same district from date of joining.

12th November 1897.—*Promotion ceased.*—In consequence of the return of M Balaji Singh Ranger, Fifth Grade, from leave, the acting promotion of Swaminatha Iyer to Fifth Grade of Ranger ordered in service order No. 41 of 1897-98 ceased with effect from 18th October 1897.

13th November 1897.—*Privilege leave.*—To C. Rajagopaul Naidu, Ranger, Sixth Grade, Cuddapah district, for fifteen days from 5th November 1897, under article 291 of the Civil Service Regulations.

22nd November 1897.—No. 554.—Mr. H. B. Bryant, District Forest Officer, Tinnevelly, is granted privilege leave for two months and eleven days, in continuation of the Christmas Holidays, under article 291 of the Civil Service Regulations.

29th November 1897.—No. 562.—Mr. H. A. Gass, Acting Conservator of Forests, Southern Circle, is granted special leave on urgent private affairs for six months, with effect from or after the 20th December 1897, under article 348 of the Civil Service Regulations.

3.—BOMBAY GAZETTE.

1st November 1897.—No. 2258.—Messrs. G. P. Millett, Deputy Conservator of Forests Third Grade, and W. F. D. Fisher, acting Deputy Conservator of Forests, Fourth Grade, respectively delivered over and received charge of the Working Plans Divisional Forest Office, N. C., on the 30th October 1897, in the afternoon.

2nd November 1897.—No 4415.—Mr. S. Hornidge, A.M.I.C.E., and Mr. C. Greatheed, Deputy Conservators of Forests, respectively delivered over and received charge of the Divisional Forest Office, Ahmednagar, on the forenoon of the 28th October 1897

3rd November 1897.—No. 4424.—Mr. W. F. D. Fisher, acting Deputy Conservator of Forests, delivered over and Mr. S. Hornidge, A.M.I.C.E., Deputy Conservator of Forests, received charge of the Divisional Forest Office Sholápur, on the afternoon of the 29th October 1897.

4th November 1897.—No. 8029.—In supersession of the order posting Mr. D. A Thomson to Surat (Government Notification No 7446, dated 11th October 1897), His Excellency the Governor in Council is pleased to appoint Mr. E. M. Hodgson to act as Divisional Forest Officer, Surat, and to direct that he be under the orders of the District Magistrate of Surat for Plague duty.

5th November 1897.—No. 2315.—Messrs. C. G. Dalia, extra Assistant Conservator of Forests, Third Grade, and E. M. Hodgson, Assistant Conservator of Forests, Second Grade, respectively delivered over and received charge of the Divisional Forest Office, Surat, on the 5th November 1897, in the afternoon.

5th November 1897.—No. 4464.—Mr. G. S. Hinge, extra Assistant Conservator of Forests, delivered over and Mr. G. P Millett, Deputy Conservator of Forests, received charge of the Divisional Forest Office, Nasik, on the forenoon of the 1st instant.

8th November 1897.—No. 8111.—His Excellency the Governor in Council is pleased to appoint Mr. J. H. Clabby, on return to duty under the Bombay Government, to be under the Conservator of Forests Southern Circle, and to direct that the lowest officer in each grade of Extra Assistant Conservator of Forests, below the first should revert with effect from the date of Mr. J. H. Clabby's taking charge under the Conservator of Forests, S C.

9th November 1897.—No. 4525.—Mr. R. H. Madan, extra Deputy Conservator of Forests, delivered over and Mr. H. W. Keys, Deputy Conservator of Forests, received charge of the Divisional Forest Office, West Khándesh, on the forenoon of the 4th instant, *10th November* 1897.—No 8182 —Mr. E. M. Hodgson, Assistant Conservator of Forests, Poona, passed on the 8th October 1897 the examination in the subjects prescribed in Rule VI of the Rules published in Government Notification No. 2, dated 3rd January 1894, for the examination of officers of the Forest Department.

11th November 1897.—No. 5329.—Mr. Ganpat Jayawant Rege, extra Assistant Conservator and Personal Assistant to the Conservator of Forests, Southern Circle, is granted twenty days' privilege leave with effect from 27th October 1897.

13th November 1897.—No. 8294 —Mr. V. D. P. Rebeiro, L.C.E., extra Assistant Conservator of Forests, Third Grade, and Divisional Forest Officer, Bijápur, is allowed privilege leave of absence for two months.

17th November 1897.—No 5470.—Mr H A Nadkarni, extra Assistant Conservator, who was transferred from the Working Plans Division to the Southern Division of Kánara, to do duty as Sub-Divisional Officer there, was relieved of his duties in the former division on the afternoon of the 8th November 1897 He reported himself for duty to the Divisional Forest Officer, Southern Division of Kánara, on the forenoon of the 9th idem.

17th November 1897—No. 5471.—Mr. H. A. Nadkarni, extra Assistant Conservator of Forests, Working Plans Division, has been posted to the Southern Division of Kánara to do duty as Sub-Divisionae Officer.

18th November 1897.—No 5484.—Mr. Ganpat Jayavant Regel extra Assistant Conservator of Forests, who was on twenty days' privileg, leave from 27th October 1897, resumed charge of his duties as Personal Assistant to the Conservator of Forests, Southern Circle, on the afternoon of the 15th November 1897.

4.—BENGAL GAZETTE.

2nd November 1897.—No. 954T. R.—Under the provisions of section 67 (1) of the Indian Forest Act VII of 1878, as modified by Act V of 1890, His Honour the Lieutenant-Governor is pleased to invest the Divisional Forest Officer, Gorakhpur Forest Division, Oudh Circle, North-Western Provinces and Oudh, with powers to compound forest offences under the above named section

13th November 1897.—No. 1004T R.—Mr. W. F. Lloyd, Officiating Deputy Conservator of Forests, in charge of the Direction Division, and Personal Assistant to the Conservator of Forests, is transferred to the charge of the Tista Division.

Mr. F. Trafford, Officiating Deputy Conservator of Forests, on being relieved of the charge of the Tista Division by Mr. Lloyd, is transferred to the charge of the Direction Divison, and appointed to be Personal Assistant to the Conservator of Forests

15th November 1897.—No. 337 For.—Mr. T. H. Monteath, Assistant Conservator of Forests, attached to the Sundarbans Division, is transferred to the Darjeeling Division as an attached officer.

16th November 1897.—No. 3388For.—Mr. E. P. Stebbing, Assistant Conservator of Forests, is on return from the three months' privilege leave granted to him in Notification No. 2576 For., dated 24th August 1897, posted to the charge of the Chittagong Forest Division.

Mr. A. H. Mee, Extra Assistant Conservator of Forests, on being relieved of the charge of the Chittagong Division by Mr Stebbing, will remain attached to that Division until further orders.

22nd November 1897.—No. 3474For.—The services of Mr. W. F. Perreé, Assistant Conservator of Forests, are placed at the disposal of the Government of India.

Mr. J. W. A. Grieve, Assistant Conservator of Forests, attached to the Singhbhum Division, is posted to the charge of the Buxa Division.

5.—N.-W. P. AND OUDH GAZETTE.

19th November 1897.—No. $\frac{3498}{\text{II-622 B.}}$. The undermentioned officer has been granted by Her Majesty's Secretary of State for India permission to return to duty :—

Name.	Service.	Appointment.	Date on which permitted to return.
Mr. J. S. Gamble	Forest.	Conservator of Forests.	Within the period of leave.

6.—PUNJAB GAZETTE.

1st November 1897.—No. $\frac{575}{\text{A L No. 32}}$.—Mr. E. M. Coventry, Officiating Deputy Conservator of Forests, on return from the privilege leave granted him in the Punjab Government Notification No. 421, dated 21st August 1897, took over charge of the Montgomery Division on the afternoon of the 8th October 1897, relieving Bábu Ladha Singh, Extra Assistant Conservator of Forests, who has been attached to the Ráwalpindi Forest Division on and from the same date

1st November 1897.—No. $\frac{575}{\text{A L No. 32}}$.—*Erratum.*—In Notification No. $\frac{540}{\text{A. L. No. 30}}$.—dated 16th October 1897. *substitute* "5th July 1897" *for* "7th September 1897."

17th November 1897.—No. $\frac{603}{\text{A. L. No. 33}}$.—*Erratum.*—In Notification No. $\frac{558}{\text{A. L. No. 31}}$, dated 22nd October 1897, in the column headed "with effect from" *read* "9th October 1897," opposite Mr. C M. McCrie's name and "11th October 1897, opposite Mr. A. E. Lowrie's name.

20*th November* 1897.—No. $\frac{611}{\text{A. L. No. 34}}$.—The following changes have taken place in the list of Forest Officers in the Associated Provinces, with effect from the dates specified against each :—

Name.	Present Grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. J. H. Lace ...	Officiating Deputy Conservator, 1st Grade.	Deputy Conservator, 2nd Grade.	3rd November 1897.	Consequent on the return of Mr. F. O. Lemarchand from privilege leave.
Mr. A. E. Lowrie ...	Officiating Deputy Conservator, 2nd Grade.	Deputy Conservator, 3rd Grade.	Ditto.	
Mr. E. M. Coventry ...	Officiating Deputy Conservator, 3rd Grade.	Officiating Deputy Conservator, 4th Grade.	Ditto.	
Mr. C. M. McCrie ...	Officiating Deputy Conservator, 4th Grade.	Provisional Assistant Conservator, 1st Grade.	Ditto.	

23*rd November* 1897.—No. 615.—*Leave.*—Bhai Sàdhu Singh, Extra Assistant Conservator of Forests, is granted two months and seven days' privilege leave, under Article 291 of the Civil Service Regulations with effect from the forenoon of the 12th November 1897

30*th November* 1897.—No. $\frac{628}{\text{A. L. No. 35}}$ —Mr. C. Somers Smith, Deputy Conservator of Forests, has been granted one year's furlough with effect from 25th January 1898, or such subsequent date as he may avails himself of it.

7.—CENTRAL PROVINCES GAZETTE.

28*th October* 1897.—The following transfer of Rangers is ordered :—

Mr. Parsons, Ranger, 2nd grade, sub *pro tem.*, and Working-Plans Inspector, from the Jubbulpore Division to the charge of the Burhanpur Range, Nimar Division.

Mr. Nago Rao Ranger, 3rd grade, from the Burhanpur Range, Nimar Division, to the charge of the Jubbulpore and Sehora Range, Jubbulpore Division.

Mr. J. F. Anthony, Ranger, 3rd Grade, from the Direction Division to the Jubbulpore Division as Working-Plans Inspector

3rd November 1897.—No. 28.—The following changes have taken place in the list of Rangers in the Central Provinces with effect from the dates specified against each :—

Name.	Present grade.	Grade to which promoted.	With effect from	REMARKS,
Mr. Ganga Pershad	2nd grade	Sub *pro tem* 1st grade.	27th Aug. '97	Consequent on the resignation of Mr. A. T C. Howell, Forest Ranger, 1st grade *Sub pro tem.*
„ Ponnuswamy	Sub *pro tem* 2nd Grade	Confirmed 2nd grade	Do. Do.	
„ Faiz Bakhsh	3rd grade	Sub *pro tem* 2nd Grade	Do. Do.	
„ P. Shankernath	Sub *pro tem* 3rd grade.	Confirmed 3rd grade	Do. Do.	
„ J. D. St. Joseph	4th grade	Sub *pro tem* 3rd grade	Do. Do.	
„ W. J. Anthony	Sub *pro tem* 4th grade	Confirmed 4th grade	Do. Do.	
„ Venayak Chimaji Bhagwat.	5th grade	Sub *pro tem* 4th grade	Do. Do.	
„ Ghanshyam Pershad	Sub *pro tem* 5th	Confirmed 5th grade	Do. Do.	
„ D. G. Vishwanath	6th grade	Sub *pro tem* 5th grade.	Do. Do.	
Mr. Ganga Pershad	Sub. *pro tem.* 1st grade.	Confirmed 1st grade	28th Aug. 97.	Consequent on the appointment of Mr. Narayan Parshad, Forest Ranger, 1st grade, as Extra-Assistant Conservator, 4th grade.
„ B. I. Shama Rao	2nd grade.	Sub. *pro tem.* 1st	Do. do.	
„ S. R. Parsons	Sub. *pro tem.* 2nd grade.	Confirmed 2nd grade	Do. do.	
„ Amrit Lal Chatterjee	3rd grade.	Sub. *pro tem.* 2nd grade.	Do. do.	
„ Chhoga Lal	Sub. *pro tem.* 3rd grade.	Confirmed 3rd grade	Do. do.	
„ Bhagwant Rao Desh-Pande.	4th grade.	Sub *pro tem.* 3rd grade.	Do. do.	
„ Dinkar Vishnu Pranjpe	Sub. *pro tem.* 4th grade.	Confirmed 4th grade	Do. do.	
„ E. A. Rooke	5th grade.	Sub. *pro tem.* 4th grade.	Do. do.	
„ W. G. Slaney	Sub. *pro tem.* 5th grade.	Confirmed 5th grade	Do. do.	
„ Shyam Sundar	Do. Do.	Do Do.	Do. do.	Consequent on the resignation of Mr. O. C. Gilmore, Forest Ranger, 5th grade.

3rd November 1897.—No 29,—With the sanction of the Chief Commissioner, the resignation tendered by Mr. Bhawani Dutt, Forest Ranger, 6th grade, attached to the Southern Circle, is accepted with effect from the 1st July 1897.

4th November 1897.—No 4782.—Mr. A. M. F. Caccia, Deputy Conservator of Forests, has been granted, by Her Majesty's Secretary of State for India, three months' leave on medical certificate, in extension of the furlough on medical certificate granted him by Order No. 2250, dated the 29th April last.

5th November 1897.—No. 30.—Mr. J. D. St Joseph, Forest Ranger, 3rd grade, sub. *pro tem*, at present attached to the Direction Office, is placed on special duty and is attached to the Hoshangabad Division for work in the Bori Range.

8th November 1897.—No, 4828.—Mr. F. S. Barker, Deputy Conservator of Forests, is granted three months' leave in extention of the extraordinary leave granted him by Orders No. 1055, dated the 19th February last, and No 3656, dated the 6th August last

15th November 189 .—No. 4923.—Mr F Linnell, Assistant Conservator of Forests, on special famine duty in the Jupbulpore District, is transferred in the same capacity to the Mandla District.

Mr. Linnell assumed charge of his duties at Mandla, from Mr. Parmanand, Special Extra-Assistant Commissioner, on the afternoon of the 11th ultimo.

18th November 1897.—No. 4971. —On return from the two months and 28 days' privilege leave granted him by Orders Nos 3452 anp 4392, dated respectively the 20th July and 1st October 1897, Mr. F O. Lemarchand, Deputy Conservator of Forests, resumed charge of the Chanda Forest Division, on the forenoon of the 3rd instant, from Mr. A. St. V. Beechey, Officiating Deputy Conservator of Forests, who reverted to the charge of the Pranhita-Godavari Sub-Division

24th November 1897.—No. 5050.—Mr. F. S. Barker, Deputy Conservator of Forests, has been permitted, by Her Majesty's Secretary of State for India, to return to duty within the period of the leave granted him by the Orders noted below :—

No. 1055, dated the 19th February 1897.
No. 3656, dated the 6th August 1897.
No. 4828, dated the 8th November 1897.

25th November 1897.—No. 5082.—Privilege leave for one month and two days, under Article 291 of the Civil Service Regulations, is granted to Mr. M. Muttannah, Extra-Deputy Conservator of Forests, Nimar, with effect from the 1st December 1897, or the subsequent date on which he may avail himself of it.

25th November 1897.—No 31.—Shyam Sundar Lal, Forest Ranger, 6th grade, in the Hoshangabad Forest Division, is granted fifteen days' privilege leave, under Article 291 of the Civil Service Regulations, with effect from the 23rd October 1897.

Departmental Order No. 21, dated the 7th October 1897, is hereby cancelled.

8.—BURMA GAZETTE.

27th October 1897.—No. 27.—With reference to Revenue Department Notification No. 389 (Forests), dated the 7th October 1897, Mr. H. H. Forteath, Deputy Conservator of Forests made over, and Mr. C. W. Doveton, Assistant Conservator of Forests, received charge of the Gangaw subdivision, Yaw Forest Division on the forenoon of the 21st October 1897.

29th October 1897.—No. 369.—The following temporary alterations in rank are ordered in the Forest Department :—

(1) With effect from the 10th September 1897, consequent on the return from leave of Mr. C M. Hodgson, Deputy Conservator of Forests :

Mr. C. M. Hodgson Deputy Canservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

(2) With effect from the 25th September 1897, consequent on the return from leave of Mr. H. Jackson, Deputy Conservator of Forests, 3rd grade :

Mr. H. Jackson, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. M. Hill, Deputy Conservator, 3rd (officiating 2nd) grade, to revert to his substantive appointment.

Mr. C. B. Smales, Assistant Conservator, 1st grade (officiating Deputy Conservator, 3rd grade), to officiate as Deputy Conservator, 4th grade.

(3) With effect from the 1st October 1897, consequent on the return from privilege leave of Mr. E S. Carr, Deputy Conservator, 1st grade :—

Mr. J Copeland, Deputy Conservator, 2nd (officiating 1st) grade, to revert to his substantive appointment.

Mr. H. Jackson, Deputy Conservator, 3rd (officiating 2nd) grade, to revert to his substantive appointment.

Mr. S. Carr, Deputy Conservator, 4th grade (substantive provisional) officiating Deputy Conservator, 3rd grade, to revert to his substantive appointment.

29th October 1897.—No. 371.—Mr. C. W. Allan, Extra Deputy Conservator of Forests, is transferred to the charge of the Bassein-Myaungmya Forest division and will hold charge of the Henzada-Thôngwa division in addition to his other duties as a temporary measure.

29th October 1897 —No. 372.—On return from leave Mr G. F. R. Blackwell, Deputy Conservator of Forests, is posted to the charge of the Henzada-Thôngwa Forest division.

29th October 1897.—No. 373.—Mr. T. W. Forster, Extra Assistant Conservator of Forests, is transferred from Yamèthin to timber measurement duty in the Pyinmana Forest division.

1st November 1897.—No. 28.—Maung Shawe Le, Forest Ranger, 3rd grade, in the Upper Chindwin division, is granted three months' leave on medical certificate, with effect from the 5th September 1897.

5th November 1897.—No 385.—Mr. A. Weston, Deputy Conservator of Forests, has been granted by Her Majesty's Secretary of State for India an extension of furlough for one month.

11th November 1897 —No. 393.—Under the provisions of Article 869 of the Civil Service Regulations, leave on medical certificate for four months is granted to Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, with effect from the date on which he availed himself of it.

11*th November* 1897.—No. 894.—On return from leave Mr. F. J. Branthwaite, Deputy Conservator of Forests,is posted to the charge of the Working Plans Division, Tenasserim Circle.

12*th November* 1897.—No 29.—Mr. G. T Wrafter, Ranger, 2nd grade, on transfer to the Yaw division, made over charge of his duties in the Magwe division on the afternoon of the 1st November 1897 and assumed charge of his duties in the Yaw division on the forenoon of the 4th November 1897.

15*th November* 1897.—No. 400.—Mr. G. E. S. Cubitt, Assistant Conservator of Forests, is transferred from Prome to the Myittha Forest division.

16*th November* 1897.—No. 20.—Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, availed himself, on the afternoon of the 31st October 1897, of the four months' leave on medical certificate granted him in Revenue Department Notification No. 393 (Forests), dated the 11th November 897.

16*th November* 1897.—No 21 —Mr. F J. Branthwaite, Deputy Conservator of Forests, reported his arrival in Prome on return from the privilege leave granted him in Revenue Department Notification No. 238 (Forests), dated the 9th July 1897, on the forenoon of the 14th November 1897.

17*th November* 1897 —No. 403 —Mr. Robert Scott Troup who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forests Department as Assistant Conservator of Forests, 2nd grade, reported his arrival in Rangoon on the 15th November 1897, before noon.

Mr. Troup is posted to the headquarters of the Upper Chindwin forest division.

17*th November* 1897 —No 404.—Mr. Stephen Filgate Leppoc Cappel, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator of Forests, 2nd grade, reported his arrival in Rangoon on the 15th November 1897, before noon.

Mr. Cappel is posted to the headquarters of the Mu forest division.

17*th November.*—No. 405.—Mr. Francis Hadden Todd, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator of Forests, 2nd grade, reported his arrival in Rangoon on the 15th November 1897, before noon.

Mr. Todd is posted to the headquarters of the Yaw forest division.

17*th November* 1897.—No. 406.—Mr. Hugh Wesley Allen Watson, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator of Forests, 2nd grade, reported his arrival in Rangoon on the 15th November 1897, before noon.

Mr. Watson is posted to the headquarters of the Prome forest division.

17*th November* 1897.—No. 407.—Mr. John James Rorie, who has been appointed by Her Majesty's Secretary of State for India to the Imperial Forest Department as Assistant Conservator of Forests 2nd grade, reported his arrival in Rangoon on the 15th November 1897, before noon.

Mr. Rorie is posted to the headquarters of the Tharrawaddy forest division.

20th November 1897.—No. 22.—With reference to Revenue Department Notification No. 371 (Forests), dated the 1st November 1897, Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, and Mr. C. W. Allan, Extra Deputy Conservator of Forests, respectively made over and received charge of the Bassein-Myaungmya division on the afternoon of the 31st October 1897.

20th November 1897.—No. 23.—With reference to Revenue Depart- Notification No. 372 (Forests), dated the 1st November 1897, Mr. C. W. ment Allan, Extra Deputy Conservator of Forests, and Mr. G. F. R. Blackwell, Deputy Conservator of Forests, respectively made over and received charge of the Henzada-Thôngwa division on the forenoon of the 18th November 1897.

22nd November 1897.—No. 416.—On his return from privilege leave Mr. C. Ingram, Extra Deputy Conservator of Forests, is posted to duty in the Shwegyin Forest division.

23rd November 1897.—No. 418.—Mr. A. E. Ross, Assistant Conservator of Forests, was on duty at the headquarters of the Katha Forest division from the 7th to the 16th November 1897, before noon.

9.—ASSAM GAZETTE.—*Nil.*

10—HYDERABAD RESIDENCY GAZETTE.

8th November 1897.—No. 300.—The following posting and transfers among Extra Assistant Conservators of Forests in Bearar are ordered by the Resident:—

Mr. Mansukh Rai is posted to the Amraoti Forest Division on return from the privilege leave granted him in *Residency Orders*, Notification No. 207, dated the 28th July 1897.

Mr. B. Bhukan is transferred from the Amraoti Division to the Buldana Division.

Mr. W. G. J. Peake is attached to the Akola Division on being relieved of the Buldana Division by Mr. Bhukan.

11—MYSORE GAZETTE.

6th November 1897.—No. 4102—*Ft. F.* 93-95.—The extraordinary leave without allowances granted to Mr. C. E. M. Russell, Deputy Conservator of Forests, Kadur district, under Notifications Nos. 5741—Ft. 380 and 5690—Ft. F. 93-95, dated respectively the 29th December 1895, and the 23rd December, 1896, is hereby extended for a further period of one year.

PLANTING UP

OF

SHIFTING SANDS NEAR DRESDEN

IN

SAXONY.

BY

A. M. REUTHER,

INDIAN FOREST SERVICE.

CALCUTTA:
OFFICE OF THE SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA.
1894.

PLANTING UP OF SHIFTING SANDS NEAR DRESDEN IN SAXONY.

Situation. Area. Exposure of soil.

A considerable area situated within the Dresden Forest Circle has since many years been leased by the Military Department with the object of providing parade-grounds for the Cavalry and Infantry Regiments stationed there. In 1867 it was decided to extend the parade-grounds, for which purpose a further area of 100 hectares was included in the lease; and in order to obviate payment of compensation, the Military Department allowed the tree-stumps to be extracted, and the litter to be removed, from this area after the forest on it had been clear felled.

Configuration and nature of soil. Shifting sand. Effects of soil disturbance.

The surface-configuration of this area is undulating, and the soil consists mostly of pure sand, containing here and there an admixture of clay up to 18 or 19 per cent. Very soon after the complete exposure of the soil, the sandy surface began to grow unstable, and already in 1870 the shifting sand, moved by the wind, covered not only the adjacent Cavalry parade-ground, but also blocked the more distant "Königsbrücker" Chaussée to such an extent as to interrupt all traffic on it. In the next few years the evil assumed such large proportions that it was found absolutely necessary to reafforest the area with the least possible delay.

Reafforestation operations. Wattled fencing. Planting birch and alder. Planting Scotch Pine.

Operations were commenced in 1874 by covering the whole area with a network of wattled fencing. Strong stakes, 7 to 9 cm. in diameter, were driven into the ground 60 cm. apart, in rows 20 m. apart running south to north, and interwoven with branches of Scotch Pine, the wattled fencing thus formed being 80 cm. high. At right angles to these lines of fencing similar fences were made, about 50 m. apart, and 60 cm. high. Towards the west, where the general surface-elevation is higher and exposed mounds and ridges exist, the fences were placed closer together than on the more sheltered east side, so that the average area of each rectangle enclosed by the fences was about 1 rood on the west, and about 2 roods on the east side. The shifting of the sand was thus greatly reduced, and restricted within the enclosures; and already in 1875 it became possible to begin planting. In that year birch and alder were planted in rows along the fences (on the sheltered side), the planting holes being filled with good soil brought from a distance—and in the following year planting up of the interior of each rectangle was begun, with Scotch Pine plants 1 to 2 years old, which were put out in squares with the aid of Buttlar's planting tool, 8,000 plants being used per hectare, and each plant supplied with a handful of good humus soil. The compost was prepared in autumn and left lying in heaps during the winter, and conveyed to the site of the plantation just before the planting season in spring.

Results. The results are quite satisfactory in so far as the ground is now fully stocked, and the surface-soil completely consolidated. But owing to the dryness and poverty of the soil, the growth of the plants is in many places very miserable, many of the Scotch Pines being only 1 metre high though already 15 to 18 years old. The average height is, however, about 5 m., and for the most part the plants have closed overhead. **Protection of the area planted.** The entire area has been most carefully protected; cattle have been strictly excluded, and grass cutting disallowed, and all unauthorised persons have been prohibited from walking across it. These precautions were absolutely necessary to prevent disturbance of the unstable surface-soil, and to give the plants a chance of establishing themselves.

Cost of cultural operations. The cost of the cultural operations was 44·10 mk. per hectare. The wattled fencing was constructed by a local battalion of Pioneers, and therefore involved no direct outlay; had the work been done by paid labourers, **Cost of fencing.** the cost would have been about 0·20 mk. (2½*d.*) per running metre of fencing.